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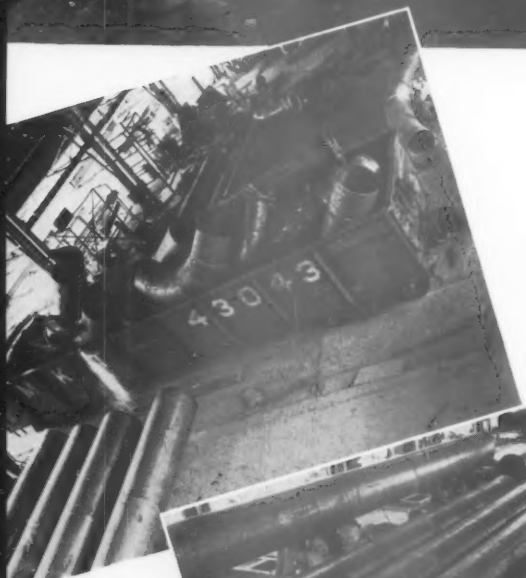

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POLYMERIZATION

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Trends

Crude-Oil Production
By States—Page 138

CRUDE-OIL STOCKS 226,397,000 bbl. as of Oct. 20—down 1,157,000 bbl. One year ago 221,711,000 bbl.

GASOLINE STOCKS 71,185,000 bbl. as of Oct. 20—up 394,000 bbl. One year ago 77,743,000 bbl.

RESIDUAL FUEL-OIL STOCKS 45,808,000 bbl. as of Oct. 20—up 355,000 bbl. One year ago 64,087,000 bbl.

GAS OIL AND DISTILLATE STOCKS 42,875,000 bbl. as of Oct. 20—up 915,000 bbl. One year ago 46,837,000 bbl.

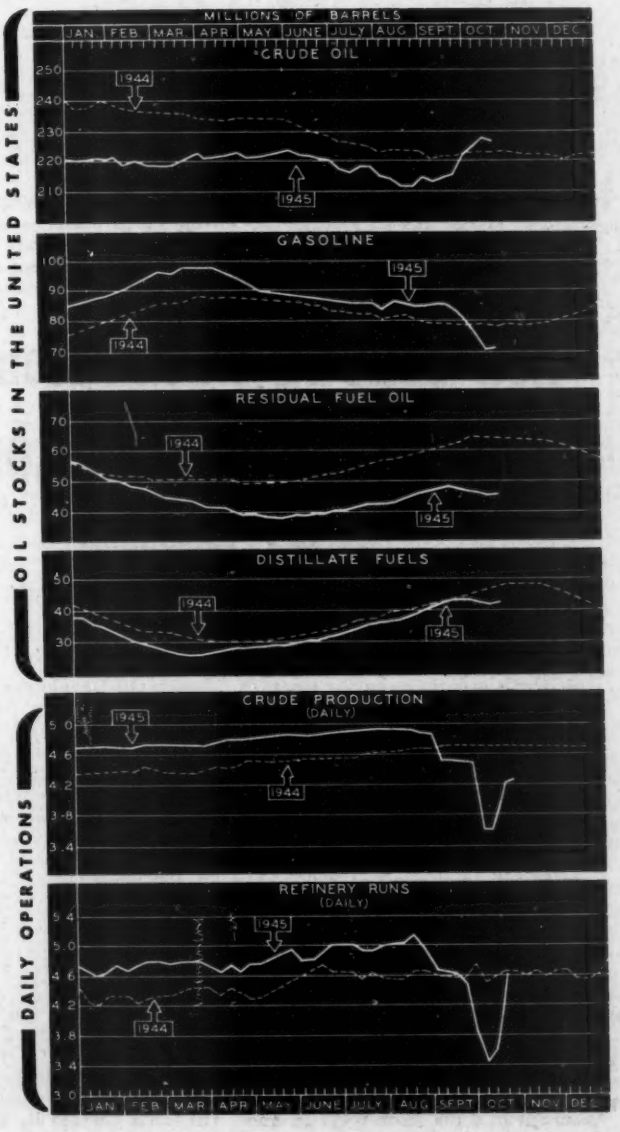
CRUDE-OIL PRODUCTION 4,270,000 bbl. as of Oct. 27—up 42,150 bbl. One year ago 4,737,800 bbl.

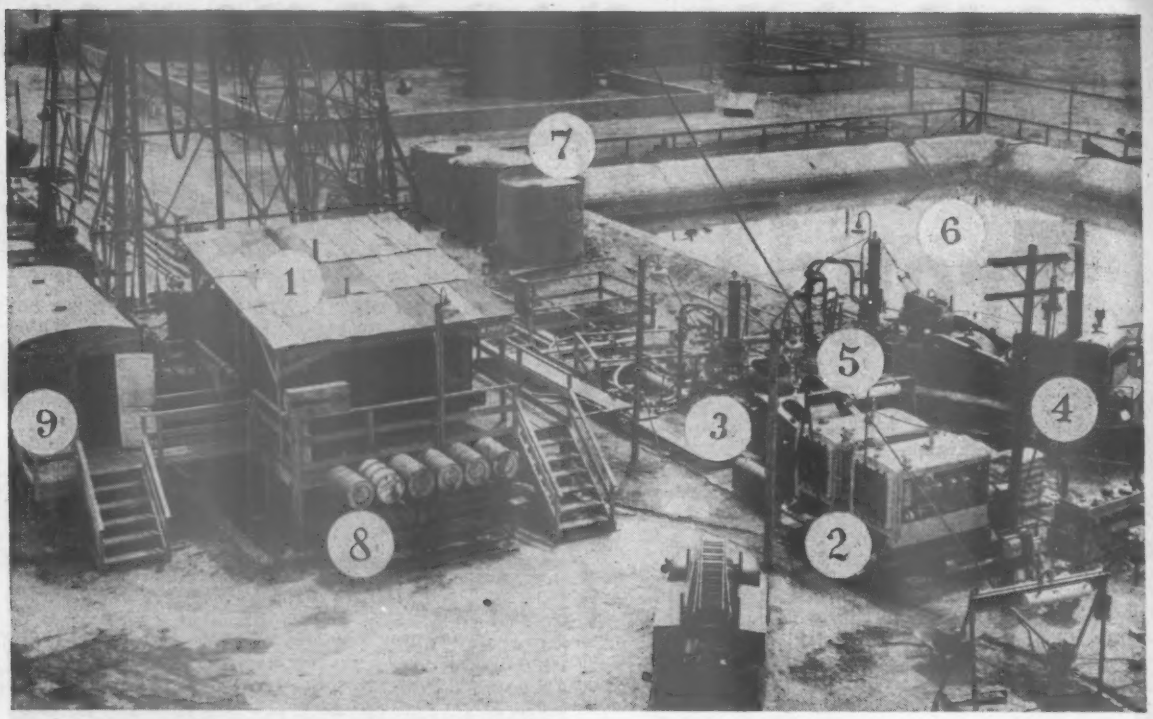
REFINERY RUNS 4,635,000 bbl. daily week ended Oct. 20—up 1,026,000 bbl. One year ago 4,696,000 bbl.

THE upswing of postwar demand for domestic petroleum will develop in the fourth quarter of 1946. This forecast of the trend in petroleum requirements was made by the working subcommittee of the Petroleum Industry War Council committee on economics. The rise in the fourth quarter next year will follow a series of comparatively mild reductions in the first 9 months of next year, receding to a low point of 4,668,000 bbl. per day in the third quarter. The average total demand for 1946 of 4,728,000 bbl. per day is substantially higher than many previous estimates and results, the committee explained, from greater military requirements than had been anticipated.

TOTAL demand for the fourth quarter of this year estimated at 5,094,000 bbl. daily, including more than 300,000 bbl. per day of natural gasoline and allied products, reflects the need for increasing producing and refining operations to offset the work stoppage at many plants in September and October. During the refinery strikes in the latter part of September and the fore part of October, stocks of finished gasoline dropped 13,700,000 bbl. Inventories of fuel oil and kerosene were reduced 4,500,000 bbl. in the same period. Refinery operations during remainder of the winter probably will have to be maintained at a greater rate than previously expected in order to bring the supply of fuel oil in balance with demand.

THE necessary adjustment of refinery operations to yield larger quantities of fuel oil is unfortunate because of lower market value of the heavier products. It is generally conceded that maximum imports of burning oils of approximately 200,000 bbl. per day during the fourth quarter will be inadequate to offset the decline in stocks and loss of production during the strikes. Data available to the PIWC subcommittee on probable imports in 1946 were not sufficient to set up a satisfactory figure. Imports probably will rise to some extent during the fuel-oil consuming season but supplies available for shipment to this country, most observers believe, will not prove adequate. Therefore, the domestic refining industry will be forced to accept an operating pattern which does not produce the most desirable economic results. There is no doubt, however, that demand for crude oil is projected on a firm basis.





Over-all view of General Petroleum's drilling equipment in the Wilmington field in which (1) marks the shed covering the diesels and draw works; and (2) indicates two 150-hp. diesels which power mud pump (3). Number (4) shows an older power unit and (5) an auxiliary mud pump which together are substituting for another new power and mud pump unit as yet undelivered. The waste sump is indicated by (6), while (7) marks three 100-bbl. mud-storage tanks and (8) points out drums of lubricating oils. Number (9) indicates the dog house or portable change room for the crew

New Zone in Wilmington May Increase Reserve 25,000,000 Bbl.

by L. P. Stockman

LOS ANGELES.—A new zone has been found productive in the Wilmington field of Los Angeles County, California, discovery of which will greatly augment reserves of this field. Wilmington has produced over 275,000,000 bbl. of crude oil and has a conservatively estimated reserve of approximately 350,000,000 bbl. Production of over 55,000 bbl. per acre has already been achieved and some sections of the field have exceeded 100,000 bbl. per acre. The field average of 55,000 bbl. per acre is relatively low because the townlot areas and blocks producing only from the Ranger zone have not shown production comparable with those blocks producing from several zones.

The new zone at Wilmington was originally found by Union Pacific Railroad Co., in its No. 237, which was plugged back from the schist basement at 6,133 ft. to 5,477 ft. and completed in the overlying Ford zone of Miocene age.

The first actual completion in the zone was well No. 97-W of Long Beach Oil Development Co., finished a few weeks ago flowing 415 bbl. daily of exceptionally clean 30.8°-gravity oil through a choke from a total depth of 6,228 ft. with a packer at 6,150 ft.This zone, which shows high porosity and permeability, is a 200-ft. interval of oil sand located approximately 450 ft. below the base of the Ford zone. Long Beach Oil Development Co. only produced the lower 78 ft. of oil sand in its initial completion in the new zone and cased off the upper portion in order to get the most favorable gas-oil ratio and thus maintain reservoir pressure as far as possible.

The new zone is known to exist in portions of Blocks 2 and 3 but has not been delineated. Richfield Oil Corp. carried its 34 Pacific Dock down to basement at 6,952 ft. but this well, located in Block 4, missed the new zone and subsequently set a whipstock at 5,465 ft. and was completed in the Ford zone at a redrilled depth of 5,825 ft. Ford zone development in the Ford area, Block 2, is fairly well along but has not started aggressively in the Long Beach Harbor area, Block 3, where it is expected to prove highly productive.

The Wilmington field is divided into several segments by faulting and since there is no migration of oil or gas across the faults due to vertical displacement of the various segments it is possible to develop the field in sections. The Wilmington, Ford, Edison, Long Beach, and the Allied faults are all of major structural importance and show a northwest-southeast trend transverse to the axis but the power-line fault, another structural feature, shows a northeast-southwest direction. Several other minor, but also important faults, extend at various angles from the general trend of complex faulting in the area. The Wilmington structure is an anticlinal nose plunging to the northwest.

In contrast with conditions existing in most other California fields, due to displacement and pinch out of sands, there is no uniformity of productive zones across the entire

New Venezuelan Government to Respect Oil Law

This declaration of petroleum policy by the Venezuelan Revolutionary Government was issued exclusively to Marian C. Cody, editorial representative at Caracas for the Journal and its affiliated publication, Petroleo Interamericano. This is believed to be the first concise disclosure of the new government's attitude toward the petroleum industry. It was transmitted by cablegram to expedite dissemination to United States oil companies who have extensive investments in Venezuelan oil properties.

CARACAS (By cable). — In an exclusive interview with The Oil and Gas Journal's representative, Dr. Juan Pablo Perez Alfonzo, newly appointed minister of fomento and legal counsel for the Junta Revolutionary Government, outlined the new provisional government's policies regarding petroleum interests.

"When a new government like the one we have comes into power," he said, "no existing law is controlling since it is a government not constitutionally ordained and therefore has no constitutional limits to its own power. However, we do not propose to establish an arbitrary government. Our first decree established that every law, statute, and all constitutional guarantees in existence prior to the formation of the present government would be recognized and enforced with the exception of that part of the statutes that is not compatible with the functioning of this de facto government.

"We are going to respect the oil law of 1943 and the contracts made according to the law. Concession agreements, royalties holdings, exploration and exploitation commitments will remain the same. Our purpose will be limited to determining if present federal revenues accruing from royalties are honestly calculated.

"The present provisional government does not contemplate any change in the law. The accion democratica at the time of the passage of the 1943 oil law by Congress and represented in Congress among others by myself was opposed to the law. We believed that it could have been conceived in such a way that benefits coming from the oil exploitation could have been more equitably divided between the government and the oil companies and the profit percentage for both parties made more stable, not subject to the fluctuating price of oil on the world markets.

"The Oficina Tecnica de Hidrocarburos de Venezuela, petroleum bureau, was created by presidential decree March 1943 as a division of the ministry of fomento. It is the intention of the ministry of fomento to retain the entire personnel of the Oficina Tecnica from the director of the office on down through all the various branches. We will make no changes unless justified by the existence of irregularities which we are confident is not the case.

"Attitude of the new government toward the oil companies, petroleum interests and every other legitimate private industry, as I have often reiterated, without discrimination between the different industries or the countries from which the foreign capital originates will be respected and defended by our transitional government. From an equitable point of view we think that the defense of our national economy and the necessity of using foreign capital for development of our natural resources can be harmonized without trouble. Security is a necessity for the normal progress of production and we are aware of that fact. Our policy will be in accordance with this knowledge.

"The present government feels that it is to its best interest to permit development of its petroleum resources under the present arrangement of foreign capital and technicians. There is no intention to nationalize the industry nor to expropriate properties.

"Prevailing wage scales will be examined to ascertain if labor is being adequately compensated."

field although the tar sand and Ranger zone are present and productive in all blocks. In the most easterly block, only the Ranger is productive, although, at high structural positions adjacent to the tideland, Terminal zone production has been developed. In the most westerly area, Block 1, comprising the town-lot area, the Ranger and Ford are productive but the Ford zone in this segment is relatively thin and has low porosity and permeability with consequent small production. The Ranger at the west end of Wilmington overlaps the east end of the Torrance field but the Ford pinches out before reaching Torrance. Multiple-zone completions are not favored at Wilmington due to operating difficulties and the inability to undertake corrective work if one zone goes to water or a well sands up.

There are seven productive horizons at Wilmington although all are productive only in Blocks 2 and 3, including the Long Beach Harbor block, in about the geographic center of the field. These zones are the (1) tar sand; (2) Ranger zone; (3) upper Terminal; (4) lower Terminal; (5) Union Pacific; (6) Ford and (7) the new zone, which may be designated as 237 since it was discovered in Union Pacific's well No. 237. General Petroleum Corp. may have found this zone in its discovery well, 1 Terminal, and classified the entire section as the Ford sand but the reported 750 ft. thickness of the Ford interval would not include the new sand. Some mechanical trouble was experienced in the initial well and very little was known of structural conditions at the time the well was drilled.

A substantial part of the highly productive Long Beach Harbor block extends southeast under the tideland area beneath the water of the Pacific Ocean. The structure appears to rise as it extends outward and thus a large reserve may be beyond reach except that part which can be drained by directionally drilled wells from the upland. A proposal was made last year to permit a prospecting company to tunnel beneath the tidelands and construct a subterranean chamber in which wells could be directionally drilled to intercept that portion of the reservoir which might be beyond reach of directionally drilled holes whose surface location would be on the upland area. This subterranean drilling would be reached by tunnels extending from the upland area.

Recently H. A. Hansen, a civil engineer and vice president of Dynamics Industries Co., renewed the proposal which would be costly but entirely feasible. The Long Beach city council took the matter under advisement. Favorable action is considered doubtful as Long Beach is the principal recipient of revenues of Long Beach Oil Development Co. which is at present developing tideland property by directional drilling.

Current production of the Wilmington field approximates 100,000 bbl. daily, 9 years after discovery. Gas production is relatively small and consequently wells show unusually low gas-oil ratios.

XUM

Special Committee to Consider Continuing PIWC Activity

by Henry D. Ralph

WASHINGTON. — A special committee of 23 members to consider continuing cooperative industry activity has been appointed by William R. Boyd, Jr., chairman of Petroleum Industry War Council, and is expected to report at the next meeting, December 11.

Chairman of the committee is W. Alton Jones, president of Cities Service Co. Other members are: Don T. Andrus, president, Pennsylvania Grade Crude Oil Association; O. D. Donnell, president, The Ohio Oil Co.; J. Frank Drake, president, Gulf Oil Corp.; J. H. Dunn, president, Natural Gasoline Association of America; W. H. Ferguson, executive vice president, Continental Oil Co.; B. A. Hardey, president, Independent Petroleum Association of America; C. L. Henderson, president, Western Petroleum Refiners Association; Fred W. Herligy, president, National Oil Marketers Association; George A. Hill, Jr., president, Houston Oil Co. of Texas; Eugene Holman, president, Standard Oil Co. (New Jersey); W. F. Humphrey, president, Tide Water Associated Oil Co.; J. C. Hunter, president, Mid - Continent Oil & Gas Association; B. Brewster Jennings, president, Socony-Vacuum Oil Co., Inc.; Ralph B. Lloyd, president, Western Oil & Gas Association; Harry A. Logan, president, National Petroleum Association; B. L. Majewski, vice president, Deep Rock Oil Corp.; W. S. S. Rodgers, chairman of the board, The Texas Co.; Charles F. Roeser, president, Roeser & Pendleton, Inc.; G. L. Rowsey, president, Gulf Coast Refiners Association; H. L. Thatcher, chairman, National Council of Independent Petroleum Associations; C. P. Watson, president, Oil Producers Agency of California; Robert E. Wilson, chairman of the board, Standard Oil Co. (Indiana).

For all practical purposes the council wound up its functioning with its October 24 meeting, but there was general reluctance to break up organization which had operated well for the benefit of the entire industry, and many members declared PIWC had assisted both large and small companies in many problems.

Last week's meeting was devoted almost entirely to reviewing the war jobs now completed and exchanging mutual congratulations. Most committees made what presumably were final reports and prepared to turn their files over to the still-functioning historical-records committee.

Discuss Anglo-American Pact

Much of the discussion at the council meeting was devoted to the revised Anglo - American petroleum treaty, and a resolution was adopted favoring its early ratification by the Senate. Petroleum Administrator Harold L. Ickes and Deputy Administrator Ralph K. Davies reported on their recent trip to London to negotiate the new agreement, as did several of the council members who accompanied the delegation as advisers. In the course of his remarks Ickes explained that the highly controversial and now dormant Petroleum Reserves Corp. was formed chiefly to serve as a threat of direct U. S. Government action abroad unless an international agreement were reached, and that PRC may now be considered dead.

The council meeting carried over the good fellowship engendered at a formal banquet which the oil industry tendered Ickes and Davies the preceding evening, attended by a large group of invited guests from the oil industry and Washington officialdom. In addition to informal speeches in which the industry and Government men exchanged both humorous and serious compliments and congratulations, Ickes and Davies were presented with large bronze plaques bearing their portraits carved by C. Paul Jennewein, prominent New York sculptor. Each dinner guest received a medallion bearing a small replica of the two sculptures.

At the council meeting the following day Davies was presented with an additional token of esteem, an elaborate world globe, and the council authorized the painting of a portrait of Mrs. Ickes as a gift to the administrator.

Among the resolutions adopted were endorsement of the public-land and natural-gas sections of the report of the national oil policy committee, a declaration that imports of petroleum should be regulated to avoid disturbing the domestic producing industry, and several votes of thanks to various committees. The council voted to abandon the proposed joint product conservation advertising campaign and to return the unspent portion of the fund already collected.

Lucas Medal Awarded to J. O. Lewis

JAMES OGIER LEWIS, consulting petroleum geologist, of Houston, was awarded the Anthony F. Lucas Gold Medal for 1946 by the board of directors of American Institute of Mining and Metallurgical Engineers at a meeting in New York October 24. The medal, which recognizes "distinguished achievement in improving the technique and practice in finding and producing petroleum," will be presented at the annual meeting of the institute, to be held February 25-28, 1946, in Chicago.

JAMES O. LEWIS

Born in San Jose, Calif., January 21, 1886, Lewis graduated from Leland Stanford University in 1909, majoring in geology. Until 1915 he was employed as a geologist by oil companies in California and then became supervisor of drilling operations on Indian lands for Bureau of Mines. Later he was named chief petroleum geologist of the bureau. Since 1920 he has been in private practice as a consultant.

The Lucas Medal, established in April 1936, has been presented to such distinguished members of A. I. M. E. as J. Edgar Pew, 1937; Henry L. Doherty, 1939; E. De Golyer, 1940; Conrad and Marcel Schlumberger, 1941; John Suman, 1943, and Charles V. Millikan, 1944.

THIS WEEK

FOREIGN— Venezuelan Revolutionary Government to continue previous oil policy with minimum disruption. . . . Foreign companies proceed with development programs, accepting declaration without reservation. . . . ¶Creation of military government in Brazil continues epidemic of Latin-American revolutions. . . . ¶PIWC urges prompt Senate ratification of Anglo-American oil agreement. . . . ¶Controversial Petroleum Reserves Corp. may be considered dead, Administrator Ickes tells council. . . . PRC setup as threat of direct government oil instrumentality to expedite agreement with British. . . .

DEMAND—Domestic and export requirements for crude-oil and refinery products expected to average 4,728,000 bbl. daily next year. . . . Calculations made by PIWC economics committee higher than many previous estimates of 1946 demand. . . . ¶Bureau of Mines resumes peacetime function of forecasting crude-oil demand, replacing wartime quotas assigned various states by PAW. . . . November requirements for crude estimated by bureau at 4,600,000 bbl. daily. . . . ¶Peak wartime requirements were reached last June—5,003,000 bbl. of crude daily. . . . ¶Refinery operations must be maintained at higher levels than previously expected for rest of this year and first quarter of next to offset losses in production and stocks during strikes. . . .

DRILLING— Total completions down slightly, finaled wildcats rise. . . . ¶National rate of more than 500 completions per week will approximately accomplish the PAW goal of 27,000 wells for the year. . . . ¶Discovery of new pay zone in California's Wilmington field may add 25,000,000 bbl. of new reserves. . . .

RECONVERSION— Chairman Boyd appoints committee to study plans for permanent organization to replace PIWC. . . . Committee members represent cross-section of industry. . . . Proponents assert lasting benefits will accrue to all elements in the business from such a forum. . . . ¶Administrator Ickes and Deputy Administrator Davies honored at PIWC banquet. . . . High praise sounded for their wartime services. . . . ¶Last council meeting scheduled December 11. . . .

IMPORTS— Receipts of foreign oil next year probably will average slightly more than 20,000 bbl. per day. . . . ¶PIWC resolution calls for imports no greater than required to balance domestic supply with demand. . . . Domestic industry will be strengthened by such policy, PIWC asserts. . . .

TRANSPORTATION— All tankers released to private owners by War Shipping Administration November 1. . . . PAW abolishes all regulation over supply and transportation, simultaneously. . . . ¶Surplus Property Board ready to release its views on disposition of war emergency pipe lines. . . . O'Mahoney committee to consider same problem at hearings starting in Washington November 15. . . .

LABOR— Navy urging C.I.O. oil union and companies to resume collective bargaining discussions. . . . Union wants nation-wide contract, companies insist on individual plant negotiations. . . . Union president wants Navy to step out of picture so discussions can be continued with management. . . . Navy anxious to be relieved of operating responsibility but expects to remain until uninterrupted production is assured. . . . ¶Meeting called November 5 by President Truman may supply more definite pattern for future labor relations. . . .

As far as the eye can see, in fact for 7 miles, oil stocks line the Hamburg-Bremen, Germany, superhighway. They represent the overflow of Allied fuel oil brought over during the war and now are being drawn on to supply peacetime transport and convoy traffic of foodstuffs through the British occupied zones. Such scenes are enough to make oil-famished Europeans' mouths water and eyes pop

International News Photo

XUM

Key to Industry's Problems Is In Leadership, Says Gallagher

NEW YORK. — Government regulation of industry may be expected to the extent that "the private leaders of our country fail to accept and meet the responsibilities that society has entrusted to them," Ralph W. Gallagher, chairman of Standard Oil Co. (New Jersey), warned American Gas Association at the annual meeting here October 24 and 25.

Gallagher discussed the issue of how far the power of government will be used to regulate, and to what degree such regulation may become permanent. So-called government interference, he said, often is not really interference at all, "but is induced by the inadequacy of those who normally are depended on to meet the need. If America has proper leadership, few situations will arise which will call for intervention by Government in the private affairs of its citizens."

Poe Summarizes Hearings

E. Holley Poe, industry consultant, summed up the net results of the two hearings already held in connection with Federal Power Commission's investigation. Commenting on the testimony given at the Kansas City and Oklahoma City hearings in October, Poe said: "We find the same old familiar faces of the natural-gas obstructionists—the coal industry and its satellites, railroad and labor spokesmen—appearing to dispute any evidence that may tend to disprove the necessity for further federal encroachment into the regulation of natural gas."

Poe set forth a series of assumptions which he called basic to the industry's viewpoint in the case:

"1. We assume that the purpose of the investigation is to bolster an anticipated request to Congress, by the commission, for more comprehensive powers to regulate and control natural gas.

"2. We regard it as completely impossible to separate considerations of natural-gas policies from those of all other energy resources, particularly coal and oil.

"3. Therefore, agencies and industries will have to be investigated that are not subject to the jurisdiction of the commission.

"4. Where essential facts respecting other fuels are not readily forthcoming from voluntary industry witnesses, it must be our responsibility to direct the investigation into these neglected channels.

"5. We will present, as the industry's case, all available or obtainable information that we believe falls within the scope of the commission's legitimate interest under the present Natural Gas Act as amended—and no more.

"6. The summary of the industry's case will be a brief for reasonable regulation, held at the minimum consistent with the public good, and permitting freedom for economic expansion in the public interest."

Poe said the FPC probe has blocked off the right of other government agencies to discuss the natural-gas question, and the diversity of evidence so far presented "will supply the commission with some degree of weight and authority to bolster almost any conclusions that it may care to draw in making its recommendations to Congress."

Industry Makes Gains

The hearings have resulted in some gains to the industry, Poe said, citing the optimistic picture given of United States natural-gas resources—a reserve of at least 140 trillion cubic feet already proved. Waste in the dry-gas fields has been stopped through regulations adopted with the industry's consent, without litigation.

"The industry is convinced," said Poe, "that the commission's jurisdiction should be restricted and not enlarged. The great majority of the state commissions agree with the industry in this respect."

Other speakers at the A.G.A. meeting were J. French Robinson, retiring president; Gov. Clarence W. Meadows, of West Virginia, and Col. Hudson W. Reed, president of Philadelphia Gas Works Co., Philadelphia.

The association will hold its 1946 meeting at Atlantic City, N. J., during the week of October 19.

No Date Set for Removal Of Crude-Price Control

WASHINGTON.—Office of Price Administration officials this week denied that any date had been set for removing price control of crude oil. Rumors that ceilings would be abolished around the first of the year arose, apparently, from publication of a schedule of decontrols submitted in September to a congressional committee. At that time, Price Administrator Chester Bowles indicated that consideration might be given to decontrolling industrial and raw materials early in 1946.

Controls will end, OPA spokesmen said, when supply and demand are equalized and prices show signs of dropping. No weakening in crude-oil prices has become evident yet, they pointed out.

The whole question is tied in to some extent with decision on continuance of the subsidy program. There would be no legal justification for continuing subsidy payments after price controls had been removed. Discussions among OPA, Defense Supplies Corp., and Office of War Mobilization and Reconversion are taking place, but no immediate action is expected on the subsidy question.

Jersey Officials Will Tour European Properties

NEW YORK. — Five officials of Standard Oil Co. (New Jersey) are making an intensive tour of company properties in Europe, the first such trip that company representatives have made since the outbreak of war in Europe in 1939.

The group is gathering data on the amount of physical rehabilitation needed, and its cost, for the re-establishment of business in the former war-isolated areas. The schedule includes calls to England, France, Belgium, Holland, Denmark, Sweden, and Norway. The Jersey officials will leave Europe returning to New York about November 1.

Jersey Standard is preparing a report covering the last 5 years of company operation for distribution to stockholders and employes abroad, who because of the war have been cut off from information about the company.

In the party now touring the Continent are R. T. Haslam, director of the company; Leo Welch, treasurer; E. E. Soubry, coordinator of foreign marketing; E. F. Johnson, chief counsel, and W. J. Haley, coordinator of foreign refining.

Russell Relates How Germany Gambled Desperately for Oil

WASHINGTON. — The story of Germany's desperate gamble on oil for her war machine and the decisive effect of Allied bombing of strategic Nazi oil targets was told this week in a summary report by the U. S. Strategic Bombing Survey. Robert P. Russell, president of Standard Oil Development Corp., directed the oil division of the survey, an impartial civilian group assigned to make a critical appraisal of the effects of the air war against Germany.

While some air operations were less successful than originally believed and some important bombing opportunities were unexploited, the survey concluded that attacks upon enemy oil resources contributed heavily to the collapse of the Reich.

Starting the war with less than 6 months' wartime supply of all liquid fuels, Germany quickly enlarged her synthetic-fuels capacity and through captured stocks and control over Polish, Romanian, and Hungarian sources was able to fuel her early offensives without difficulty. From 1942 on, however, fuel shortages dogged the Germans. Ultimate loss of control of air superiority was due, the survey reported, to shortages in aviation fuel which forced a cutting down of pilot training.

The technical integration of both hydrogenation and Fischer-Tropsch synthetic-oil plants with the chemical industry made the effects of bombing oil targets triply effective, crippling the munitions and explosives industries and severely affecting the synthetic-rubber industry.

Source of Aviation Fuel

Chief source of the German oil supply and only aviation gasoline source was 13 synthetic plants together with small production from others which began operation in 1944. Major sources of crude-oil products were the Ploesti fields in Romania and the Hungarian fields, together furnishing about a third of Germany's liquid-fuels supply in 1943. The spectacular and costly raid on the Ploesti refineries in August 1943 was only temporarily effective, but repeated raids beginning in April 1944, plus the mining of the Danube, cut the Romanian deliveries materially. Russian occupation of Romania in August 1944 put Germany back on her own domestic resources.

From May 1944 to May 1945, major attacks of the Eighth and Fifteenth Air Forces and the R.A.F. were concentrated on the German hydrogenation plants, which produced virtually all the aviation gasoline for the Luftwaffe. These included Leuna, Politz, Gelsenberg, Brux, Bohlen, Zeitz, Wesseling, Scholven, Magdeburg, Welheim, Moosbierbaum, Ludwigshafen, and Lutzkendorf, which accounted for 3,431,000 tons of production in 1943, plus three new installations, Heydebreck, Blechhammer-North, and Auschwitz, which were kept from effective production by bombings. Refineries in the Hamburg-Bremen area and the Ruhr Fischer-Tropsch plants were also attacked, but 47 per cent of the bomb tonnage was dropped on the hydrogenation plants.

Effect of Bombings

The story of Leuna illustrates the effect of repeated bombing and the all-out German effort at repairs and protection of the plants. A raid May 12, 1944, halted production, but a repair crew of several thousand men had the plant open in 10 days. After a May 28 raid, partial production was resumed June 3 and the plant reached 75 per cent of capacity by July. Hit again on July 7, Leuna opened again 2 days later, reached 53 per cent of capacity by July 19. The next day it was hit again, forcing a 2-day shutdown, but by July 27 it was producing at 35 per cent of capacity. July, August, and September attacks closed the plant and kept it closed, but on October 14 it opened again, reaching 28 per cent of capacity November 20. In spite of six more attacks, production was held to an average of 15 per cent of capacity to the end of the war. It took 1 year, 6,552 bomber sorties and 18,328 tons of bombs to put Leuna out of commission.

As many as 350,000 Germans were employed repairing, rebuilding, seeking to disperse bombed plants and building the underground installations which never came into use. Badly bombed plants were cannabalized to repair others. The critical condition of German fuels at the time of the Allied invasion of Normandy, when consumption was already exceeding production, is illustrated by a letter from Albert Speer, minister of armaments and war production, to Hitler on June 30, 1944. Unless the oil installations could be protected, Speer said, stocks would be exhausted quickly. Among necessary steps to limit fuel usage, Speer named reduction of flying, strict measures to cut consumption of motor and diesel fuel by the Army, increased fighter protection and more flak protection of the oil plants, even at the expense of German cities.

Liquid fuels were increasingly tight for the Germans throughout the last year of the war. The Ardennes offensive was launched without sufficient fuel to support it, and the Germans counted on capturing Allied stocks. The Nazi retreat from this offensive, American generals reported, was marked by acute shortage of fuel until April when the Nazi armies were virtually immobilized. The shortage was equally acute on the eastern front. Some 1,200 tanks massed at Baranov to hold the line in Silesia against Russia were immobilized for lack of gasoline.

Three Plants Not Bombed

A major opportunity in the Allied air offensive against oil targets was left unexploited, the survey reported. German production of tetraethyl lead came from three plants, and one plant only supplied ethylene dibromide. These plants were not bombed, although the equipment and processes used made them highly vulnerable to air attack.

While bombing of synthetic-rubber plants was sporadic, production suffered from the repeated strikes at the oil installations. Schkopau rubber production was eventually lost completely because it was dependent upon Leuna, 5 miles away, for its supply of hydrogen. Huels got a major raid only once, but its operations depended on gas from synthetic oil plants at Scholven and Gelsenberg in the Ruhr, both put out of action through repeated raids. Huels, however, was still producing rubber at the annual rate of 20,000 tons in 1944.

Additional byproduct of the attacks on petroleum targets was a sharp reduction in chemicals for ammunition and agriculture. Sixty per cent of nitrogen production and 40 per cent of methanol production for Germany came from two synthetic plants. Toward the end of the war, there was a general shortage of ammunition on all fronts.

The survey's report summarizes some 200 volumes of separate studies covering all phases of the attacks of the combined bomber offensive. Over 1,200 men took part in the survey, and teams went in with the Allied armies to capture documents, interview prisoners, and examine the effects of the air attack upon specific targets.

The survey is now engaged in a similar study of the effect of air warfare against Japan.

XUM

Demand for Crude To Be Above Earlier Postwar Estimates

WASHINGTON. — Total domestic and export demand for crude oil and products for 1946 is expected to average 4,728,000 bbl. per day. This conclusion was reached in the final report by the committee on petroleum economies, Petroleum Industry War Council, submitted here last week.

The report, explained the committee, is not a program or recommendation, nor a forecast of how the industry will or should operate during the next 15 months. The study represents probable demand with calculations projected to cover crude-oil production and runs to stills.

The 1946 estimate by the PIWC committee is considerably above most of the independent estimates. This is mainly because military estimates are higher than anticipated. The indicated daily demand for 4,728,000 bbl. of crude and products in 1946 is 359,000 bbl. higher than in 1941 and 648,000 bbl. above the 1939-1941 average as shown by Bureau of Mines figures.

During the war, peak military onshore and offshore demand plus exports and war shipping requirements, was around 1,700,000 bbl. per day. Corresponding postwar demand figures, excluding anticipated depletion of military stocks, are shown in Table 1.

Comparisons by quarters during 1946 with current levels are shown in Table 2. These appear to indicate that the low point in anticipated future demand will probably come in the second and third quarters of next year.

Nature of Differences

There are also expected to be important differences in the composition of demand, by products, compared with prewar trends. Potential demand for gasoline during 1946 is greater, of course, than the figure shown in Table 3 but the estimated combined effect upon the demand for this product of lower registrations, condition of cars, availability of parts and tires have all been reflected in the figures. Principal product comparisons are shown in daily averages in the accompanying tabulation. Product percentages of total demand are also shown.

Figures in Table 3 indicate a substantial shift of total demand toward more fuel oil and less gasoline for 1946 than prewar. These percentages are at very substantial variance with the attainable yields of the refining industry especially in view of the installation of catalytic cracking which make yields of over 50 per cent gasoline and around 12 per cent of heavy fuel readily attainable. The importation of substantial quantities of heavy fuel oil will be necessary to meet the indicated demands if uneconomic refinery operations are to be avoided, the committee continued.

Comparison of the expected change in daily average demand for principal products—1946 versus 1941, and 1946 versus average of 1939-1941 appear in Table 4.

Domestic crude-oil production during September averaged 4,680,000 bbl. per day. The October 1945 levels set by the regulatory bodies as allowable total about 4,465,000 bbl. daily. Based on various import assumptions, the domestic crude-oil production figures corresponding to the demands referred to earlier average about 4,500,000 bbl. daily during the fourth quarter of 1945 and will be about 4,170,000 bbl. daily on an average over 1946 if imports continue at around 285,000 bbl. per day of crude plus residual. Complete details of that calculation by quarters for the year and explanation of the various possible assumptions are indicated in Table 5.

The subcommittee figures are based on the assumption of no net change in the level of crude oil and product inventories between October 1, 1945 and December 1, 1946, except seasonal variations. Calculations on the basis of this assumption and the range of assumptions as to imports indicate that corresponding runs to stills during the last quarter of this year are 4,515,000 bbl. daily and for 1946 average between 4,040,000 and 4,146,000 bbl. daily. Runs to stills during September 1945 are estimated to have been 4,370,000 bbl. daily as compared with 4,785,000 bbl. daily during the first half of this year and 4,780,000 bbl. daily during the third quarter.

TABLE 1—MILITARY AND WAR SHIPPING REQUIREMENTS BY QUARTERS

Fourth 1945	First 1946	Second 1946	Third 1946	Fourth 1946	Year 1946
1,062,000	809,000	869,000	827,000	771,000	819,000

TABLE 2—TOTAL DEMAND, DAILY AVERAGES, BY QUARTERS

Fourth 1945	First 1946	Second 1946	Third 1946	Fourth 1946	Year 1946
5,094,000	4,744,000	4,692,000	4,668,000	4,821,000	4,728,000

TABLE 3—DEMAND FOR PRINCIPAL PRODUCTS, DAILY AVERAGE BY YEARS

Demand for:	1939	1940	1941	1944	1946
Gasoline	1,636,000	1,680,000	1,903,000	2,014,000	1,884,000
Per cent of total	42.0	42.2	43.6	39.2	39.8
Kerosene	187,000	194,000	198,000	210,000	229,000
Per cent of total	4.8	4.9	4.5	4.1	4.9
Distillate fuels	467,000	491,000	520,000	691,000	649,000
Per cent of total	12.0	12.4	11.9	13.5	13.7
Residual fuels	921,000	968,000	1,089,000	1,433,000	1,217,000
Per cent of total	23.7	24.3	24.9	27.9	25.7

TABLE 4—COMPARISON OF PREWAR AND POSTWAR DEMAND

	1946 vs. 1941		1946 vs. 1939-41 average	
	Bbl. daily	Per cent	Bbl. daily	Per cent
Gasoline	— 19,000	— 1.0	+144,000	+ 8.2
Kerosene	+ 31,000	+15.7	+ 36,000	+18.6
Distillate fuels	+129,000	+14.8	+156,000	+31.6
Residual fuels	+128,000	+11.7	+224,000	+22.6
Total demand	+359,000	+ 8.2	+648,000	+15.9

TABLE 5—IMPORT ANALYSIS—BARRELS DAILY BY QUARTERS

	Fourth 1945	First 1946	Second 1946	Third 1946	Fourth 1946	Total 1946
Crude oil	200	170	190	175	150	171
Products other than residual	10	10	10	10	10	10
Residual assumption 1	75	100	100	100	100	100
Residual assumption 2	75	150	150	150	150	150
(Maximum availability) 3	75	150	185	250	240	206

Discrimination in Gasoline Prices Alleged by FTC

WASHINGTON. — Standard Oil Co. of Indiana has been ordered by Federal Trade Commission to cease alleged violation of the Robinson-Patman Act by discriminating in its gasoline prices among different purchasers. The company is said to have sold gasoline to four dealers in the Detroit metropolitan area at prices lower than those charged other retailer-purchasers regularly supplied in the same area. The case centers about classification of the buyers.

A spokesman for the company said its attorneys believe the commission's findings not justified. An appeal will be taken to determine whether the transactions involved were actually violations of the law. What Standard did, it was explained, was to adopt selling methods which competitors were employing in order to hold its business against this competition. No action was brought against the others.

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BY PATRICK C. BOYLE

the OIL AND GAS JOURNAL

Evaluating War Contributions

LONDON, England.—No history of petroleum's contributions to Allied victory in World War 2 will be complete unless it chronicles adequately the activities of the Eastern Hemisphere.

It has been charged that the owners of the eastern fields contrived, with the aid of their governments, to conserve their oil while producers of the Western Hemisphere, centering in the United States, drained theirs to supply constantly mounting war demands. It is true that the western countries, which had more than 80 per cent of the world's prewar oil output, supplied the bulk of the Allied war requirements in both the European and Far East theaters.

But there is no evidence that British, French, Dutch, and American operators did not do all that could be done with their petroleum resources in this part of the world in support of the Allied cause. They maintained their peacetime output wherever possible within and adjacent to the war areas and were expanding operations as the conflicts ended. Had the war continued most of the increased military needs of 1946 and later would have been supplied from the Middle East and Near East.

In evaluating petroleum performance in this hemisphere the writer, who has visited various areas in recent weeks, is thinking primarily of the courage and sacrifice of managers and men who stayed at their jobs when there were extraordinary reasons for leaving. Now that accurate information on the East Indies and other enemy-occupied countries is available, there are reports of the individual heroism of field and plant operators demonstrating their patriotic loyalty. Many were captured because they stayed on to complete the wrecking of petroleum properties before these were taken over by the enemy.

The fields and refineries of the Near East and Middle East became part of the war area in 1940, when the bombers arrived. Then the separation of families became necessary. Wives and children were sent to South Africa and other distant points. Because of transportation and housing conditions many will not be reunited until next year.

Except those called for military service, the men holding key positions continued at their tasks. For more than 2 years they were constantly on the alert in anticipation of enemy action. Protective measures were a major activity. In northern Iraq, properties were taken over and operated by the Germans for several weeks, and British and American staffs imprisoned.

There were practically no deliveries of materials and equipment during this period, and food supplies in the isolated operations were inadequate. Despite these and other handicaps, the record will show that crude oil and products were delivered as fast as crippled transportation permitted. When the enemy's position changed to the defensive, output was expanded under most difficult conditions.

This is not an effort to give credit to one sector of the oil business over another. The writer knows of no one holding a responsible position anywhere who did not do his full duty during the emergency. But those whose activities were completely blacked out by the war's censorships must not be overlooked. Theirs was a contribution which cannot be measured solely in barrels.

XUM

No. 7

MIDDLE EAST REPORT *from the* EDITOR

Saudi Arabian Petroleum Operations Are Rapidly Reaching Major Proportions

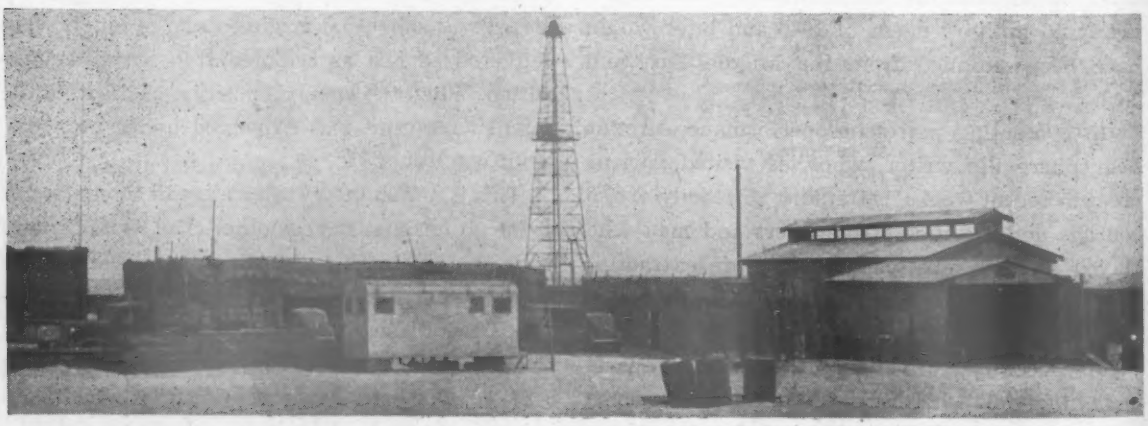
by C. O. Willson

Arabian crew drilling well in Abqaiq field

DHAHRAN, Saudi Arabia.—In this kingdom of Saudi Arabia in which centers one of the oldest world economies and cultures, an American oil operation—modern in every respect—is rapidly reaching major proportions.

It was less than a decade ago that California Arabian Standard Oil Co., subsidiary of Standard Oil Co. of California, brought in the discovery well of this vast kingdom and only 7 years have elapsed since the discovery test of an important deeper pay was successfully completed. It was necessary to carry on exploration and development on a curtailed basis, during the first years of the war. This situation was reversed, starting less than 2 years ago when the United States Army-Navy Petroleum Board approved a rapid expansion of activities in this area which includes the neighboring island of Bahrein, in order to secure needed petroleum war products.

As a result, Arabian American Oil Co., successor to California Arabian Standard Oil Co., and owned jointly by Standard of California and The Texas Co. in October started running crude oil to stills at a 50,000-bbl. refinery. The refinery will be operated at capacity by the end of the year. The fields of the company will supply the crude oil for the refinery and continue the 45,000-bbl. daily deliveries, by marine pipe



Abqaiq camp, in eastern Saudi Arabic. Living quarters are air conditioned

Aerial view of Dhahran camp

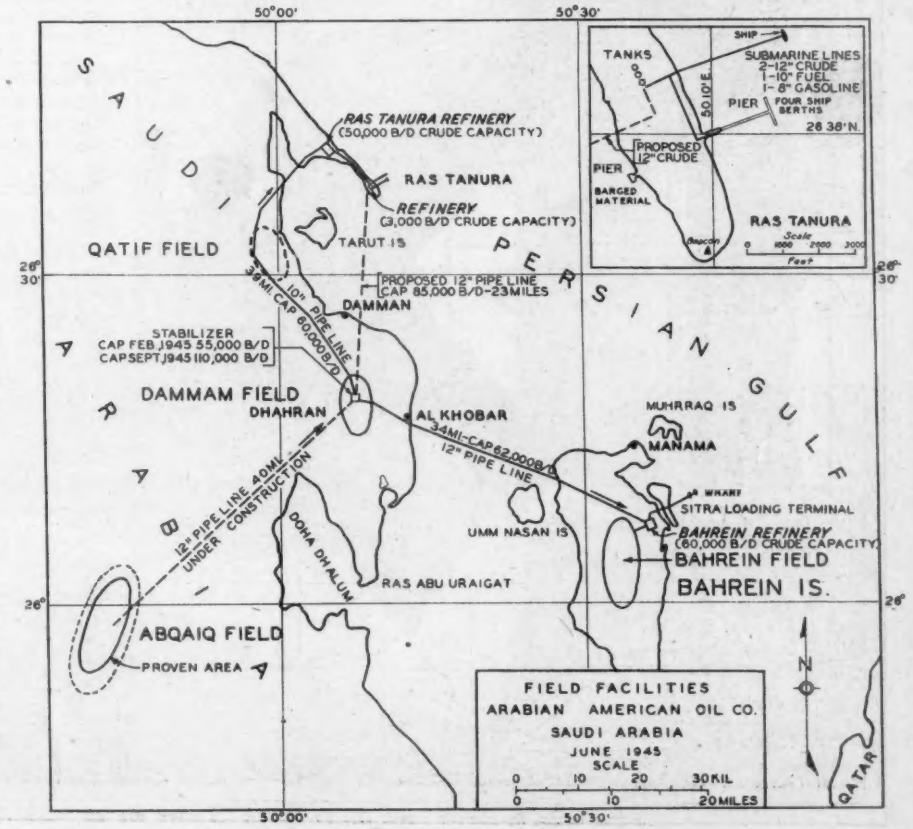
line, to the recently enlarged refinery of Bahrein Petroleum Co., Ltd. In addition to these refinery requirements, the company will be in a position to supply offshore shipments of crude oil to outside buyers. A recent contract calls for the delivery of crude oil to French refining interests.

Looking to further expansion over the next few years, the management of the company has announced plans for the construction of a 1,000 to 1,200-mile big-inch pipe line extending from the fields to Haifa, Palestine, or some other terminal point on the Eastern Mediterranean. Preliminary work on this project, which will have a capacity of 250,000 to 350,000 bbl. daily, is under way.

It has been said that no activity of the oil industry presents the contrast between the old and new as does this Persian Gulf operation. The famed King Ibn Saud is anxious to improve the standard of living of his people and at the same time strengthen the position of his nation as a world power. This fact explained his willingness in the early thirties to enter into an agreement with an American oil company to determine the petroleum possibilities of his country.

From his capital at Riyadh, King Ibn Saud and his advisers have kept in close touch with the country's oil developments and have given governmental assistance in the establishment of satisfactory operating conditions. At the same time the king has insisted that the representatives of a western civilization carry on their activities with due regard to the Arab laws, customs, and religious beliefs which have a background as old as recorded time. In part reflecting the expanding oil operations officials are taking an increasing interest in world affairs. The Saudi Arabian Government was represented at the San Francisco conference by H. R. H. Amir Faisal, Foreign Minister and Viceroy of the Hejaz, who was accompanied by three of his brothers.

Unskilled in the modern manufacturing arts the Arab nationals, including the nomadic Bedouin, are making progress in acquiring the skills associated with oil operations. About 10,000 are employed in construction and operation. Many who have been employed by the company from its beginnings now hold



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responsible positions in operations.

As one visits the fields and plants he is impressed by the fact that everything new in this operation is American. Any oil man from the "States" would not be here long until he ran across a friend.

Many of the field management and staff, including J. MacPherson, vice president and resident administrative officer, and F. W. Ohliger, general manager of the company, are from California, with other oil areas also represented. At the refinery, T. V. Stapleton, formerly of the Texas Co. refinery operations in the United States, is in charge of the refinery as assistant general manager. Marion Martin, vice president of the company with headquarters in San Francisco, is a frequent visitor to the refinery.

The Texas Co. refineries at Amarillo, San Antonio, Houston, Dallas, Tulsa, and other United States points and the Standard of California plants in California, are all represented in the operating staff. Bechtel-McCone Co., with John M. Rogers as project manager, has 2,000 Arabians, 1,500 Italians, and 650 Americans at work building the refinery. Many of the Americans have been associated with major refinery construction in the United States and Canada over the past few years.

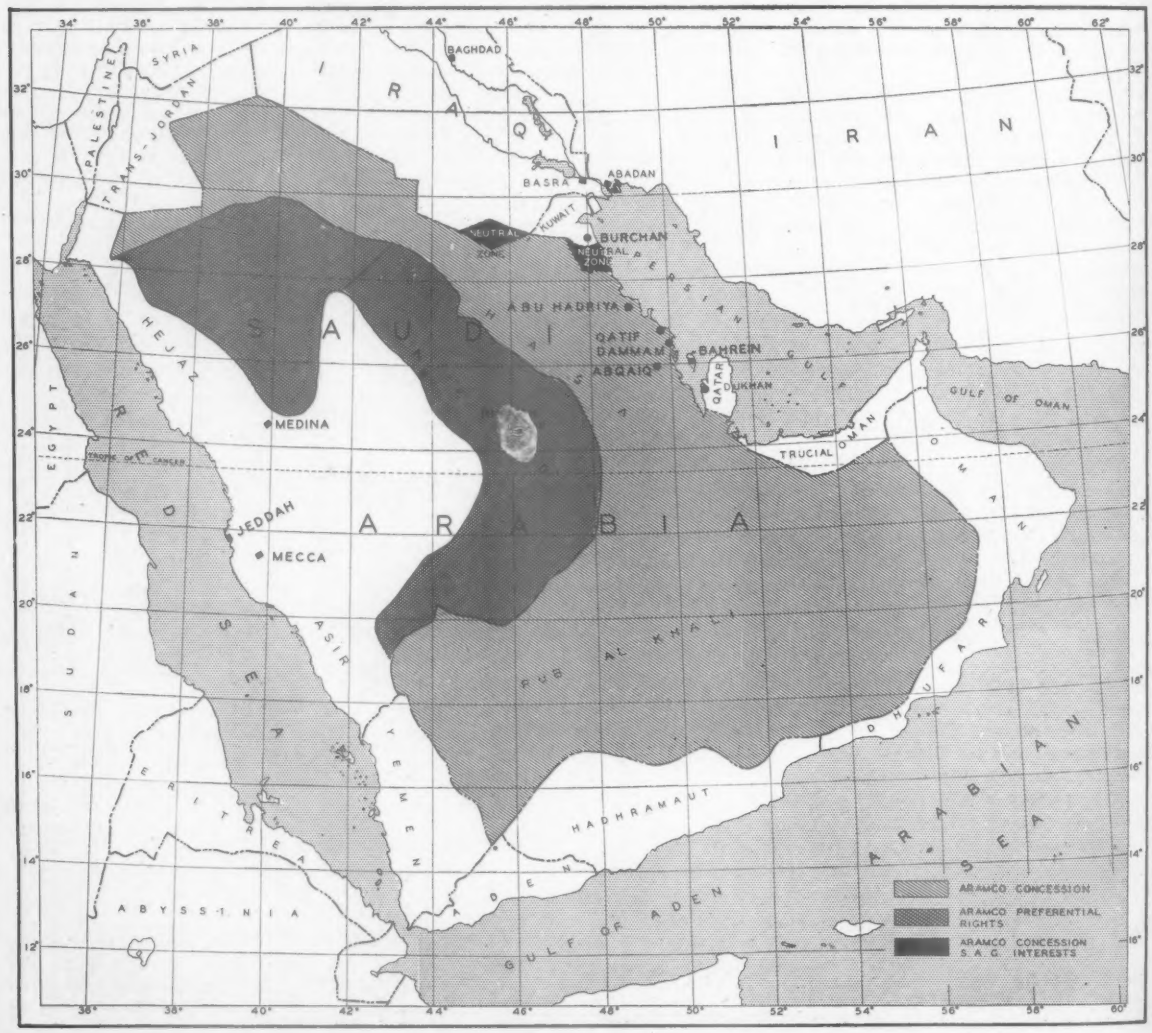
Field Headquarters

Dhahran, which includes the site of the discovery well, is the principal camp of the operation and the company headquarters. Most of the present facilities at the camp were built for a smaller production and will be enlarged as materials and manpower are available. Housing, while inadequate for present requirements, is as modern as the best of the governmental housing projects in the United States. The bungalows, hospital, club house, restaurant, and office buildings are air conditioned from centrally operated units and the same facilities are used in supplying heat during the winter months.

With very little new equipment available since the start of the war, the management has had to improvise in practically every phase of its field activities. Large shops are operated and many field activities were maintained due to the fact that these shops were able to build complete units and at the same time continue their primary functions of repair and maintenance. As in all Persian Gulf operations, the management has the responsibility of furnishing practically all supplies not only for the oil operations, but foodstuffs, clothing, and all the other essentials and many of the luxuries of the American standard of living. With supplies dependent on water shipments which during the war were often delayed for weeks or months, large warehouse facilities are provided in order to bridge the gaps between deliveries.

The camp is located a short dis-

Map showing concessions, preferential rights, and neutral-zone concessions of Arabian American Oil Co. (Aramco)



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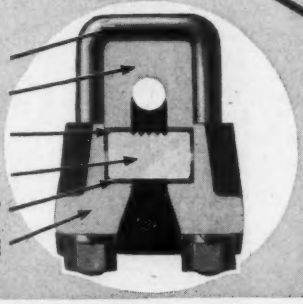

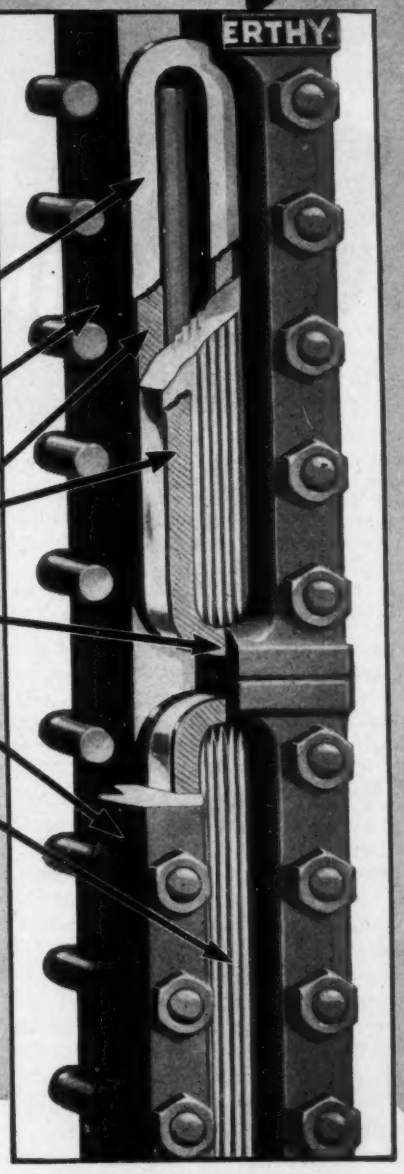

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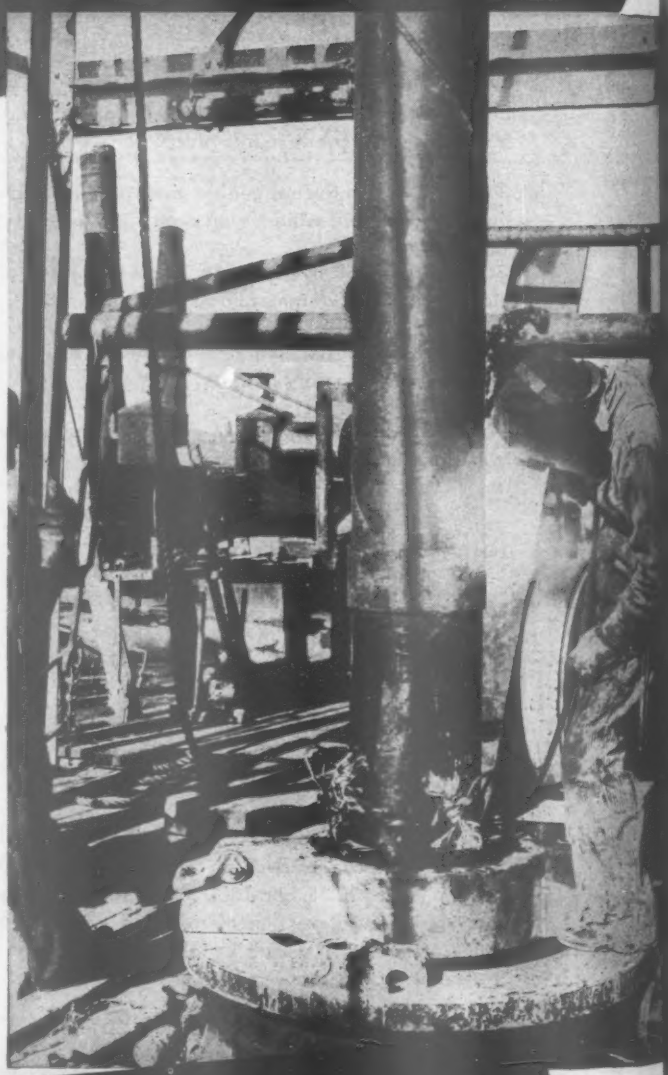

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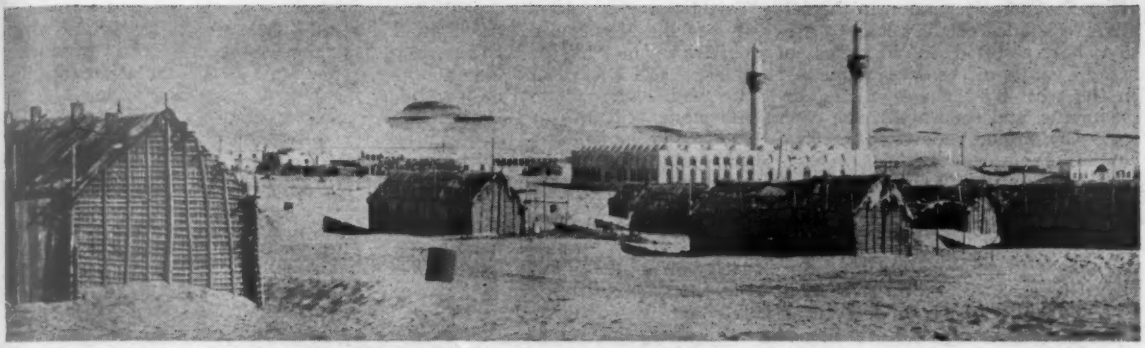

View of national workmen's camp, "barrasti," at Dhahran, with Arab mosque in background

tance from the Gulf and within the desert area. Unlike some parts of the Persian Gulf area where a water supply is all that is needed for vegetation, in this section gardens, flowers and shrubbery are only possible when soil is brought from other points. Sufficient plant life has been developed over the past few years to make the camp attractive throughout the year. The water supply comes from drilled wells with distilled water for domestic use. Each house has two sources of water supply.

Early History

The original 1933 concession of 318,000 sq. mi., negotiated by King Ibn Saud and Standard Oil Co. of California, extends along the Persian Gulf and north to the boundary of Iraq. It also includes a large area south and west of the Persian Gulf. In 1939 the present company negotiated a supplemental agreement covering 66,900 sq. mi. in the southern part of the country and 49,900 sq. mi. in the northern part. The company also has preferential rights on 177,400 sq. mi. west of the original concession. Concessions for the Saudi Arabian part of the neutral zones adjoining Kuwait and Iraq on the north have also been given the company. These concessions and rights total 611,200 sq. mi. which is approximately equal to one-fifth the land area of the United States.

The general area of the concessions and the preferential rights and the principal operating features of the first concession to date are shown in the accompanying maps.

Field Discoveries

The No. 1 well of the Dammam field was completed as a producer in December 1936 at a depth of 2,109 ft. The well was completed in what is known as the Bahrein Zone. Interest in this zone was due to the development of a large field on the island of Bahrein by Bahrein Petroleum Co., Ltd., which is also owned by Standard Oil Co. of California and the Texas Co.

Several wells were drilled to this pay. One of these wells is now producing a small quantity of crude oil and a second well supplies sweet gas for domestic use in this camp. A third well is shut in and the remaining tests have been plugged. Within a year after discovery it was known that this sand would not support a commercial petroleum development.

Encouraged by the discovery of another pay in Bahrein the management decided to drill deeper in its No. 7 Dammam and in March 1938 it was completed, a large flowing well at a depth of 4,727 ft. This well was completed in what is known as the C member of the Arab producing zone. The well is still flowing at the rate of 2,500 bbl. daily and while it has been shut in due to a lack of markets part of the time since its discovery, it had produced 4,200,000 bbl. of crude oil up to July 1 of this year. Twenty-three wells have been completed in this Arab pay. Present production, coming from a proven area approximately 5 miles long and 4 miles wide totals 70,000 bbl. daily. This production is transported by pipe line to the Bahrein and Ras Tanura refineries.

Abu Hadriya was the second field discovered. The discovery well was completed in March 1940 at a depth of 10,200 ft. It is located 100 miles northwest of Dammam and 10 miles from the coast. A second test was drilled 4,700 ft. 1½ miles southwest of the discovery well. It was shut down in October 1940 as were other drilling operations when the area was bombed by Italians. Drilling has not been resumed in this field due to the availability of oil from shallower formations in other areas. It is believed to represent a major crude-oil reserve.

The Abqaiq field which is the largest of the fields was discovered in February 1941. The first well was completed at a depth of 6,180 ft. in the D member of the Arab pay zone. The field is located 50 miles southwest of Dammam in the sand-dunes area of the desert. The A and B members are wet in this field with a 200-ft. pay section in the D member producing 37° to 39°-gravity crude oil. The C member produces a 30°-gravity crude oil. Five wells have been completed in this field which is at least 7 miles long and 3 miles wide. The field has not been defined in any direction. Drilling has been resumed and a 14-in. line will be built to the Dammam field connecting to existing pipe-line facilities at that point. It is expected that the field in early 1946 will be the principal source of supply for the Ras Tanura refinery. A new operating camp to replace the temporary facilities now in use, is also to be built as the field is expanded.

The last field to be discovered is known as Qatif. The No. 1 test was completed at a depth of 7,360 ft. and has produced from the C and D zones of the Arab Zone. The crude oil from the D zone has a 36° gravity and lower gravity from the C member. This field is 22 miles north and slightly west of Dammam. It is approximately midway between Dammam and the Ras Tanura refinery. Sites are being selected for the second and third tests.

Geology

There is practically no published information regarding the oil geology of Saudi Arabia. It is divisible into two geological provinces. The western area consists of old crystalline rocks classified as pre-Cambrian which topographically and probably structurally, slope gently to the northeast, east, and southeast. The eastern areas have sedimentary rocks which overlie the crystalline rocks which, dipping east, form a broad, somewhat curved homocline. The sedimentary sequence includes early paleozoic (primarily clastic) rocks, and exceptionally complete representation of the Mesozoic. To the east are Tertiary and later deposits.

The eastern part of the Nejd area lying west of the province of Hasa where the present production is found, is made up of a series of sedimentary rocks alternating calcareous and clastic facies ranging in age from early Paleozoic and

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lower Eocene. Alternation in the relative resistance of the rocks to erosion has resulted in a series of broad, gentle-dip slopes truncated on the west by the west-facing escarpments, and separated from each other by broad depressions. Two notable examples of these cuestas are the Tuwaiq mountains which result from resistant members of the Jurassic, and Aruma plateau which is caused by limestones of the upper Cretaceous. Structurally, disturbance of the sedimentary portion of Nejd, aside from the tilting to give the relatively uniform homoclinal dip, has been very slight.

In Hasa, surface exposures are limited to Tertiary and later rocks including lower and middle Eocene and Miocene-Pliocene, with subordinate Pleistocene and recent deposits. The Eocene is in almost exclusively calcareous facies except for one local anhydrite member. The Miocene-Pliocene is primarily continental, usually clastic and is found in a small area along the Hasa coast, a limited section with intercalated marine beds, apparently of Miocene age. Structural disturbances of the Miocene-Pliocene rocks are very slight, and the extensive areas of these rocks serve to mask much of the more fundamental geology of the area.

Subsurface Geology

Essentially all information on the pre-Miocene rocks of Hasa has been obtained from wells, which at present are limited to a few relatively widely separated areas. Only Dammam dome, and to a lesser extent Abqaiq, have sufficient wells to be regarded as reasonably well known. The Hasa wells drill through the Tertiary rocks into the upper portion of the Mesozoic sequence which outcrops in Nejd. Considerable thickness of Eocene and upper, middle and lower Cretaceous—mainly limestone except for shales and sands in the middle Cretaceous—are normally penetrated before reaching the productive rocks of the Arab zone.

The first rocks above the Arab zone to which an age can be given, are relatively high in the lower Cretaceous. The Arab zone has failed to produce diagnostic fossils.

In coastal Hasa the homoclinal dip of Nejd is no longer maintained, but rather the rocks have been deformed into low structures including those of Dammam, Abqaiq, and Abu Hadriya. Bahrein and the productive structures of Qatar are similar structures outside but near the boundaries of Saudi Arabia the structure ranges from a subcircular outline in the case of Dammam Dome, to relatively elongate forms in Bahrein and Abqaiq.

Oil Production

All Saudi Arabian oil production so far comes from limestones. In the Dammam and Abqaiq fields the Arab zone includes anhydrite members which subdivide the productive section into two to four subzones or members. Porosity and permeability of the reservoir rocks are highly variable vertically. Jointing is apparently negligible, the oil presumably being derived directly from the porosity of the reservoir rocks.

The most extensive and highly productive facies of the Arab zone is an oolite with only a small amount of cemential material. Dolomitization has considerably altered the properties of the reservoir rocks in some local areas. Thick anhydrite members capping the producing zones cause accumulation at this particular stratigraphic level.

In early 1944 the Technical Oil Commission of Petroleum Reserves Corp. gave Saudi Arabia and Bahrein Island a proven reserve estimate of 2 billion barrels. Since that time the Qatif discovery was completed and additional wells have been drilled at Abqaiq. Among geologists in this area the belief is expressed that the commission's reserve estimate for Saudi Arabia is too low, based on present discoveries. The proved reserves are now believed to approach double the amount of the 1944 estimate. The still greater possibilities of a vast area, in which only preliminary exploration has been carried on, is indicated in the presence of similar structures.

The determinable conditions of structures through the completion of a few wells and the information obtained largely through structural conditions apparently justify the large proven reserves given several fields in the Middle East. The uniformity and size of the structures, the porosity of the limestone, and the control of water and gas levels establish conditions from which the reserve estimates are based. The actual experience of older fields over a period of years has also been helpful.

Production Methods

The accompanying diagram was prepared to illustrate how the production of crude oil takes place in the 23 wells in the Dammam field, each averaging more than 2,000 bbl. daily. As previously explained, there are four members—A, B, C, and D—to the Arab zone. The cap rock and formation separating the members are dense anhydrite. The members will vary in thickness with faulting a factor in operating conditions. A representative well showed the following thicknesses in the members: A, 60 ft.; B, 25 ft.; C, 120 ft., and D, 240 ft. These figures in-

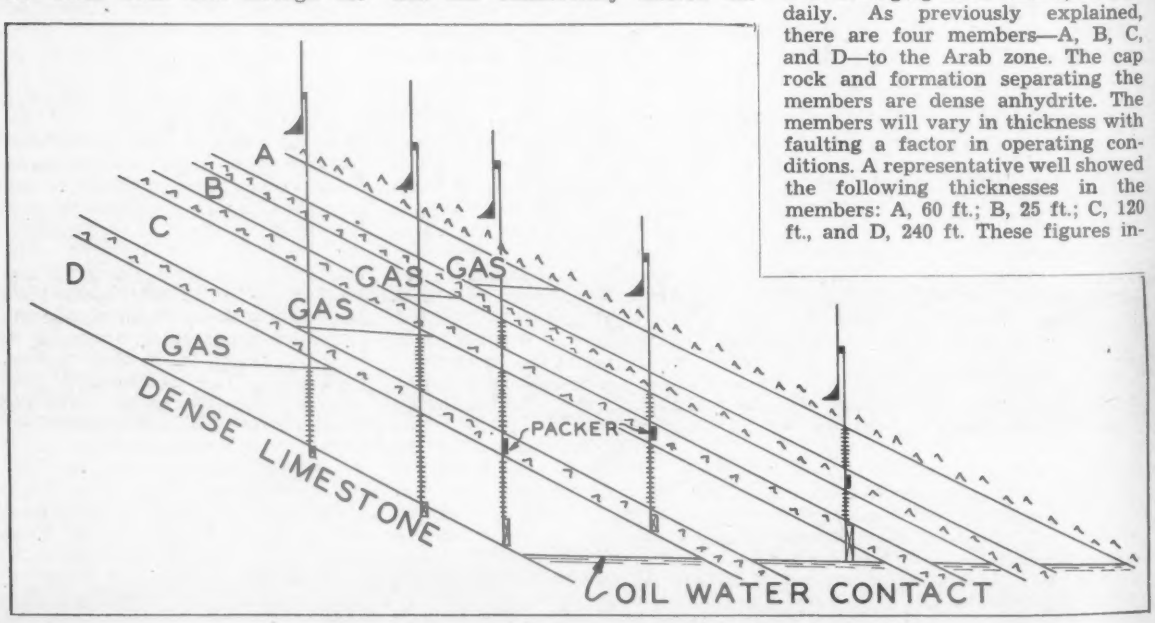

Diagram of well-completion practices, Arab zone, Dammam dome

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clude the gas column. Water level in all the formations is the same.

The method of completion is largely dependent on structure location and is determined from data obtainable in completing the wells. Where possible two or more zones are produced together. Where variations in pressures, thickness of formation, and proximity to water and gas levels justify, one or more of the zones are separated from the other zones and well is dually completed. In practice blank steel casing is cemented in place and gun perforated. When dually completed wall or anchor-type packers are set as shown in diagram, the members above the packer are produced through the annulus and the other member through the tubing. The drawdown difference in dual completions is controlled at well head.

This method of securing large production from comparatively few wells with wide spacing necessitates careful operation in the matter of gas-oil contact, water-oil contact, and the efficiency of the water and gas drives.

Stabilization

Of the 23 wells in the Dammam field, all but 4 produce from more than one zone. The reservoir shutin pressure of the wells is approximately 2,100 lb. Rate of flow is determined at the well head through control of the flow bean. Gas-oil ratios are checked regularly and the wells are controlled so as to produce no water.

In the case of the dual completions, the two streams are combined and flow under their own pressure to a central trap setting unit which is the first stage in the stabilization of the crude oil. Some of the wells are located 2½ miles from the central unit where all the wells connect to a common header.

The crude oil from the header passes to two separators. Each separator consists of two 4½ by 60-ft. horizontal vessels. The first of these two units is operated at 300 lb. and the second at 160 lb. Gas is removed from the second vessel of each unit through a header with four connections to the vessel. This separator unit has a capacity of 70,000 bbl. daily.

The crude oil from this operation passes to four 9 by 30-ft. gas traps connected in parallel. This unit is operated at 60 lb. The gas from this operation is compressed to 300 lb. and then passes to a gas rectifier unit consisting of one 4 by 70-ft. column containing 30 plates. All light fractions and the remaining H_2S are removed in this operation. The reflux for this gas rectifying operation is cooled by propane refrigeration to 70° F.

The crude oil from the 60-lb. gas trap unit is charged to three weathering columns of 7 by 57 ft. with 15 plates. An additional weathering unit consisting of a column 12 ft. in diameter and 70 ft. high is being installed. The crude is brought to a temperature of 240° F. with a reboiler which operates with 55 lb. exhaust steam from the steam turbines which supply the power for the crude pumping operation to Bahrein Island and to the local refinery near Ras Tanura. The vapor from this oil weathering operation goes to the stage gas compressors and then to the gas rectifier. This operation completes the stabilization of the crude oil and assures a maximum recovery of the desirable light hydrocarbons which are made a part of the crude oil deliveries to the refineries.

Drilling Operation

The big problem in operation is lost circulation due to the cavernous formations which are encountered. The casing program in the Dammam field is: 1,800 ft. of 16-in.; 2,600 ft. of 11¾-in.; 3,200 ft. of 8⅝-in.; 4,500 ft. of 6⅝-in. In some cases it is not necessary to run the 11¾-in.

One practice in the case of cavernous formations is to run water in the drilling operation. The water picks up the cuttings and they are forced into the cavernous formation. When cuttings accumulate above drill pipe it may result in a stuck drill pipe. To take care of this problem cutters are welded to the top of the bit and these cutters are used to drill up to dislodge the cuttings.

In formations of high water pressure, a practice* similar to that used in Bahrein has been adapted to Arabian conditions. The water is controlled through a mud cap in the annulus. The drilling continues through the high-pressure area owing to the balance maintained on the water through the floating mud cap.

A small amount of acid is used in the completion operation to remove mud sheath from production formations. The acid is pumped into the tubing and is drawn off with oil from the formation through the annulus. This produces a washing effect which removes the mud with some penetration into the formation.

Refinery

Probably no more difficult problems have ever confronted a refinery builder than those involved in the construction of the refinery near Ras Tanura. The plant was located at Ras Tanura because of the availability of deep-water shipping facilities. A small refinery has been operated at the point of Ras Tanura for several years.

*Described in an article on operating practices on Bahrein Island appearing in the October 27, 1945, issue, The Oil and Gas Journal, page 96.

The only connection that the refinery area has to the main field operation except by water is a 50-mile desert highway. This has meant that an entirely new camp has had to be established for the several thousand men who have been engaged in construction work. For the Americans, air-conditioned quarters including club house and mess hall have been provided.

All supplies for the entire camp are brought in by water shipments, the requirements being comparable to those of a small isolated army. Work has progressed satisfactorily and the first crude-oil distillation and the first reforming unit started operating in early October. The entire plant will be in operation on a basis of 50,000 bbl. daily by the first of the year.

The refinery, which was described in a previous issue,* is designed to give the maximum yields of diesel oil and Navy specification grade fuel oils. It was originally planned to install catalytic cracking facilities but these were dropped from the program when it was determined that the principal war demand at this plant was for the heavier products.

The design of the plant in many respects is similar to that of Bahrein Petroleum Co., Ltd., in Bahrein and incorporates processing methods which have been used at the refineries of Standard Oil Co. of California and The Texas Co.

The crude-distillation operation will consist of two 25,000-bbl. units providing for atmospheric and vacuum fractionation. The vacuum operation in the Bahrein plant is used to secure a large gas-oil cut for the catalytic cracking operation. At this plant it will be operated to secure the maximum yields of diesel fuel oil from a crude oil which will average approximately 36° A.P.I. gravity.

Two reforming units which can also be used to crack light gas-oil will each have a capacity of 7,000 bbl. daily. These units include the clay treating towers. The remaining distillation unit is a naphtha rerun unit.

The steam plant will consist of three 200,000-lb. boilers generating 600 lb. steam. In addition to the plant processing the steam plant will supply the requirements of an 18,000-kw. electrical power plant.

The refinery will use salt water for cooling and the consumption when the plant is in full operation will be 120,000 bbl. hourly. The water is brought into the plant by a concrete canal connecting to the Gulf. The water is then distributed under pressure through large concrete conduits built at the plant.

Construction has started on the permanent camp facilities for American employes.

*July 28, 1945, page 114.

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Dates Set for Oil Exposition, May 1947

THE next International Petroleum Exposition will be held in Tulsa, May 17 to 24, 1947. This announcement was made October 30 following a meeting of the executive committee of the International Petroleum Exposition.

The decision was based upon the results of a survey among exhibitors who expressed a 2 to 1 preference for the spring 1947 meeting over an earlier one.

This announcement of the next oil show will be of special interest in foreign oil-producing countries where plans have already been made for heavy attendance. Foreign interest and participation has increased with each oil show, and the forthcoming one, from all indications, will set a new high.

Seismograph Service Corp. Employes Hold Meeting

Approximately 150 key employes of the Seismograph Service Corp. attended a 3-day meeting in Tulsa, October 26-28. The program covered both general matters and technical discussions of various problems and phases of the company's operations in the United States, Mexico, and South America.

Considerable time was devoted to training programs and other personnel matters at sessions presided over by G. H. Westby, president, and T. A. Manhart, executive vice president. The technical sessions were under the direction of A. J. Barthelmes, vice president.

Further Conferences Asked On Labor Dispute

WASHINGTON. — Further negotiations to end the labor dispute which caused Government seizure of 49 refineries and 4 pipe lines has been requested of both union and management by Navy Department officials now in operation of the plants.

Assistant Secretary H. Struve Hensel met separately last week with a group of 17 oil-industry executives and officials of the Oil Workers International Union and asked them to resume collective bargaining discussions in good faith in an attempt to bring an early end to the dispute so that the Navy may release the properties to their owners promptly.

Hensel reiterated the position that the Navy will not attempt to settle the dispute and will not express any views on the merits of the argument, and also that Navy control is not to be considered a device for postponing negotiations and a final settlement. The Navy's only objective, he said, is to insure continued operation of the plants and to remove obstacles to collective bargaining.

Following the meetings Hensel told a press conference that both groups agreed that there is no reason for not resuming discussions, though the union insisted on a single nation-wide contract while the companies were equally insistent on plant-by-plant negotiations. He said that the Navy refused to take any position on this point, considering it to be part of the merits of the case, although he personally felt that a nation-wide conference would be unwieldly and would take too long to produce results.

Following Hensel's announcement O. A. Knight, president of the O.I.W.U., issued a statement attacking the oil companies and implying that they were defying a Navy request for a nation-wide contract.

Collier, Follis Go to New California Standard Posts

SAN FRANCISCO.—H. D. Collier, formerly president of Standard Oil Co. of California, has been made chairman of the board. He is succeeded as president by R. G. Follis, a vice president and director since 1942 and assistant to the president since last December.

Collier, president for the past 5 years, said: "It has been my wish for some time to turn over executive responsibilities to a younger man, but due to the pressure of war this had to be postponed. I plan to remain active in working on reconversion problems, but this is the time to transfer operating burdens to others."

A native of San Francisco and a graduate of Princeton, Follis first worked for Standard of California in 1924 at the Richmond refinery. After service in Bakersfield and El Paso, he was brought back to San Francisco in 1932, and in 1940 was made general manager of the manufacturing department.

Restrictions Drop on Foreign Supplies

WASHINGTON.—All restrictions over foreign supply and transportation of petroleum have been dropped by Petroleum Administration for War as of November 1 coincident with the release of tankers to their owners by War Shipping Administration.

PAW Directive 70 under which the controls were exercised will remain in effect temporarily to permit completion of programs under way, but the foreign operating committee has been directed to discontinue the activities of bulk tonnage coordinating subcommittee and the supply subcommittees for various parts of the world. This returns foreign petroleum transactions to normal commercial channels so far as this government is concerned.

DEATHS

G. J. Goodson, 50, sales manager for Bradford Motor Works in Tulsa, died October 23. He had been with Bradford Motor Works 20 years serving as sales manager the past 10 years. He previously was employed by Gulf Oil Corp. in Tulsa.

Ray Short, 65, an official of Sinclair Prairie Oil Co.'s gas department when he was retired 6 years ago, died in Tulsa October 26. He was head of the casinghead gas department of the old Prairie Oil & Gas Co. until that company was acquired by Sinclair interests.

William H. Herbert, former senior accountant for Tennessee Gas & Transmission Co., died October 23 in Shreveport.

John W. Clinkscales, 72, at the time of his retirement in 1934 gas inspector for Shell Oil Co., Inc., at Marshall, Okla., died October 26 in Tulsa. Before his association with Shell, Clinkscales was field superintendent for Oklahoma Natural Gas Co.

Wallace W. Markle, 61, oil operator in the "Thumb of Michigan" area, died October 24 in Bad Axe, Mich.

Archibald S. Sutherland, 45, assistant general traffic manager of Sun Oil Co., died October 24 shortly after being struck by an automobile near his home in Philadelphia. Sutherland joined Sun as a clerk in the traffic department in 1919, became first assistant to the manager of the department in 1937, and was appointed assistant general manager in 1943.

Henry Hauseman, 64, general traffic manager of Pure Oil Co. for 28 years, died of a heart attack October 27 in Chicago. He entered the oil business in 1911 as chief clerk in the traffic department of Indian Refining Co.'s New York office. He was vice president of Pure Transportation Co.

John G. K. Towns, oil producer and rancher of Mantalia, Gonzales County, Texas, died October 29.

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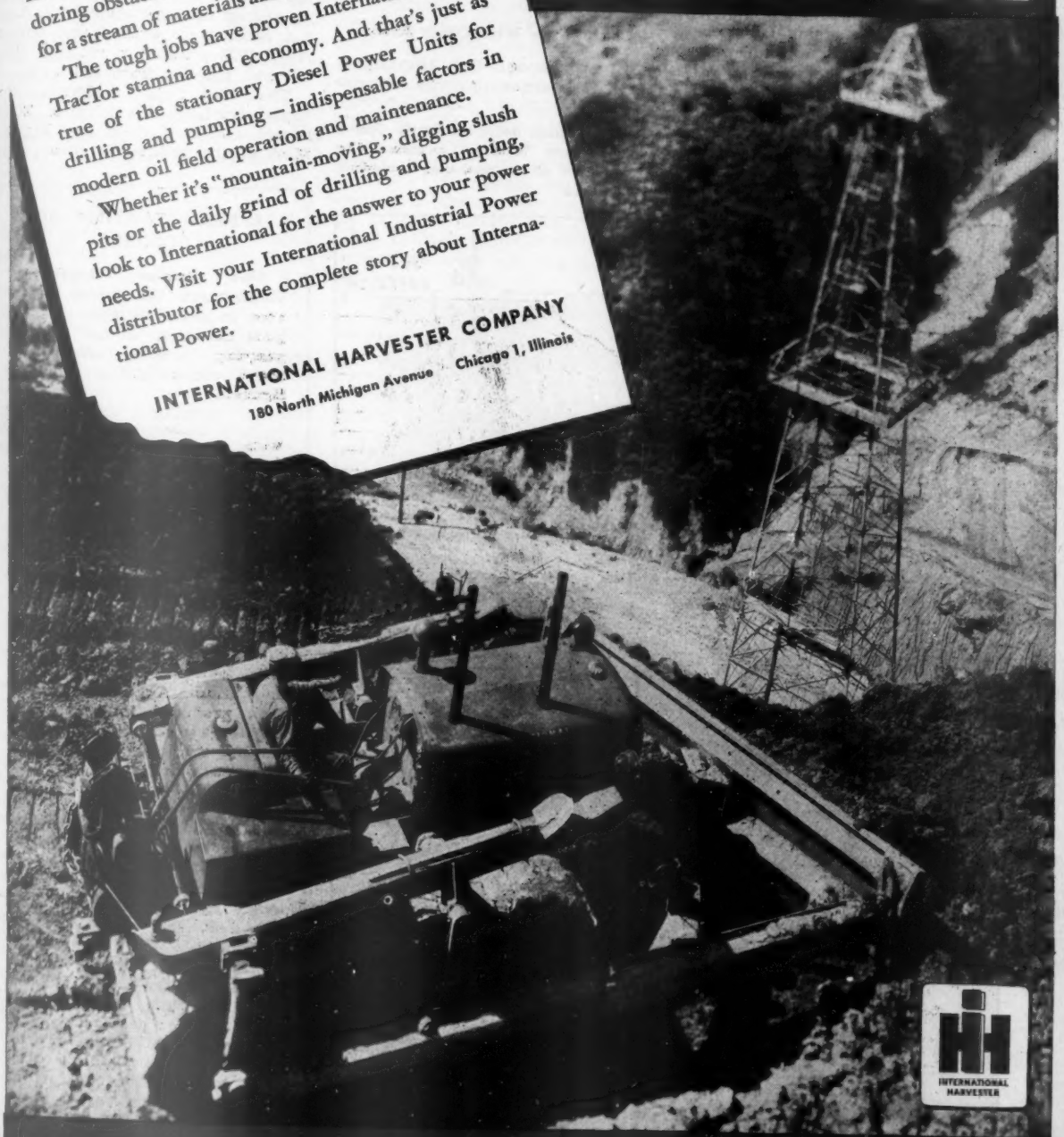

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Wells Slanted Out 3,700

THE event of producing an oil field as much as 3,700 ft. out under the Pacific Ocean is being done smoothly and efficiently at Huntington Beach, Calif. This unusual job, which at first glance would appear nearly impossible or at least fraught with hazards, is accomplished from shore locations back 300 ft. from the surf line. (Fig. 1).

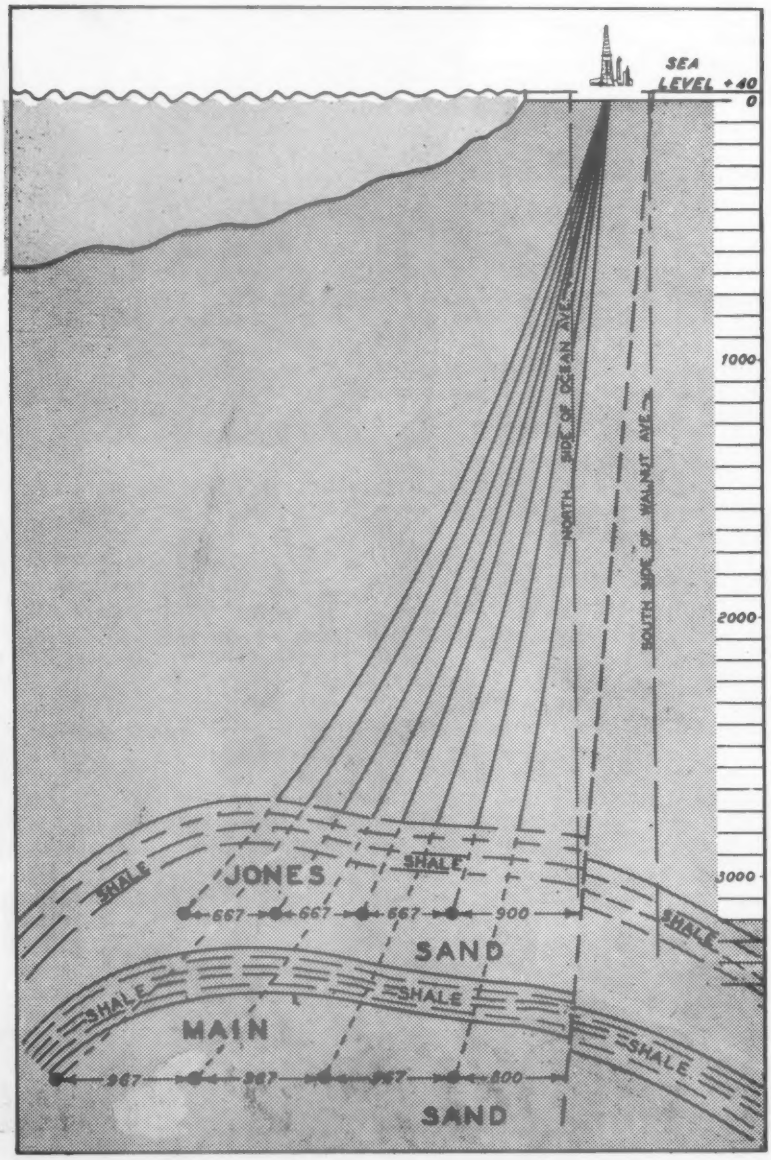
Success of operations is indicated by the results to date: 180 wells, 68.5 million barrels of oil recovered, and average production of 26,000 bbl. per day. As a singular procedure of developing an underwater oil pool, Huntington Beach "offshore" ranks with such allied projects of this nature as the drilling from special caisson supports in Lake Maracaibo of western Venezuela, the submersible barge operations along the Gulf Coast, and the pier-supported wells at Elwood and Rincon in California's northern coastal area.

Comparison With Older Areas

A trip through the Huntington Beach properties provides an excellent on-the-spot picturization of the advances that have been made in drilling and producing equipment and practices in the last 25 years. In 1920 Standard Oil Co. of California 1 Bolsa opened the area and pay sand of that name in the field for a flow of 2,000 bbl. per day. In a short time the underlying Ashton zones were drilled and during April 1923 production reached 119,000 bbl. per day from 100 wells.

The "Old field" designates the Bolsa, Garfield, Five Points, Main Street, and Surf areas (see Fig. 2). Most of the drilling in these spots

Fig. 1—Schematic illustration of how the Jones and Main sands under the Pacific Ocean, in the later drilling, have been uniformly developed from "on-shore" locations. The deflected wells reach a maximum deviation of 62°. Each of the producing formations is approximately 650 ft. thick



A REAL WARTIME OIL RECORD!

One company, Southwest Exploration Co., which operates in the Huntington Beach pool described in the accompanying article, established these commendable wartime figures:

	Dec. 7, 1941	V-J Day	Increase
Wells	42	84	100%
Av. drlg. time (ft./day)	203	271	34%
Production (bbl./day)	4,000	18,000	450%
Employes	60	61	1 man

Story of Southwest's "State" lease is truly phenomenal. Over 16,500,000 bbl. of crude oil, 36,250,000 gal. of natural gasoline, and 16,500,000,000 cu. ft. of gas have been produced. The leasehold, located under the Pacific Ocean, is drilled and produced by accurately deflected wells located on a surface strip only 100 by 4,800 ft. From this narrow confinement 381,000 ft. or 72 miles of hole have been drilled and 800,000 ft. of casing and tubing run—over 151 miles of pipe.

The drilling crews have set 430 whipstocks. They have made 3,181 roundtrips in and out of the hole — which amounts to the handling of 15,800,000 ft. of drill pipe. To put it another way: In 1,655 actual drilling days, or 4½ years, 21 men have moved approximately 3,000 miles of drill pipe. Average time to drill each well to about 4,425 ft. is 19½ days.

From standpoint of a job well done, by men inspired with the spirit of getting things done, Southwest is proud of its record, and justly!

Feet Tap Under-Ocean Pool

by **Kenneth B. Barnes**

was done between 1920 and 1928 when such valuable subsurfaces aids as core analyses, directional surveys and whipstocks, electrical logging, and the like had not appeared. Many of the Old field properties today are replete with creaky wooden derricks and pumping fronts, rickety storage, and other equipment that requires considerable repair and work to operate. However, since 1940 Signal Oil & Gas Co. has been extending the western side of the Bolsa area with good results, and the new completions there and elsewhere in the Old field appear in sharp contrast to the earlier wells.

The type electric log of Carriel[1] (Fig. 3) represents the beds and productive zones together with their geologic age which are found in the Old field. All of the indicated Pliocene and Upper Miocene sands from point "D" at the top of the Repetto to a short distance below "Z" have been productive at some structural positions and localities. In Fig. 4 are shown the geological markers and sand content of the producing formation in the Old field and Main Street sectors, as given by Wissler.[2]

Carriel[1] describes the Old field as a monoclinal limb of a central structure to the south, separated by faults, and with the sand bodies thinning and shale beds thickening upstructure. Altogether the producing areas of the Old and New fields and the Tideland pool make up, geologically, one of the most complex fields in the Los Angeles Basin. Nevertheless, the high productivity and concentration of pays are exemplified by the average past recovery of 156,000 bbl. per acre. Not only is this recovery good, but the accumulative production of 343 million barrels places Huntington Beach in fifth place among all of California's fields, as to total recovery. With future production of possibly 175 million barrels, the average ultimate yield may be on the order of 225,000 bbl. per acre. Table 1 lists a number of the production statistics by field divisions and pays.

Drilling Offshore Sector

The Seventeenth Street or "Town Lot" area started into a rapid drilling campaign in 1926, with most of the wells spaced very closely together. By December 1926 production reached a peak of 63,000 bbl. per day from 75 wells. During 1930 a reworked well which performed very favorably started a campaign of redrilling and deflecting holes, many in very random manner, to the productive area under the ocean.

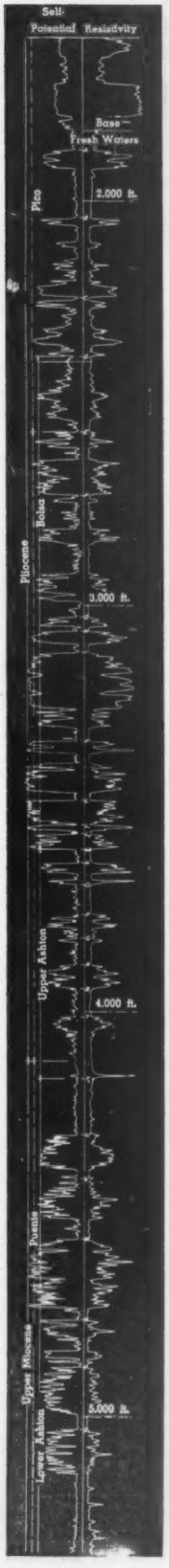


Fig. 3 — Type electrical log for the "Old Field." All of the Pliocene and Upper Miocene sands from "D" through "Z" have been productive in some Huntington areas (from Carriel)

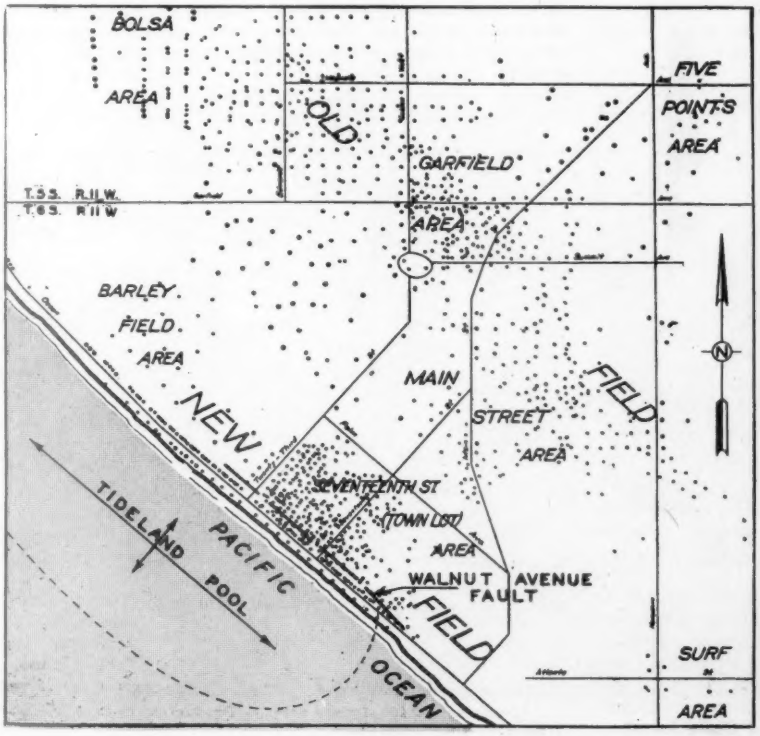


Fig. 2 — Huntington Beach is broadly divisible as to structural areas and period of development into the "Old Field" and the "New Field." Latter is classifiable into "On-Shore" and "Off-Shore," although the surface locations of all wells are on land (modified from J. T. Carriel[1])

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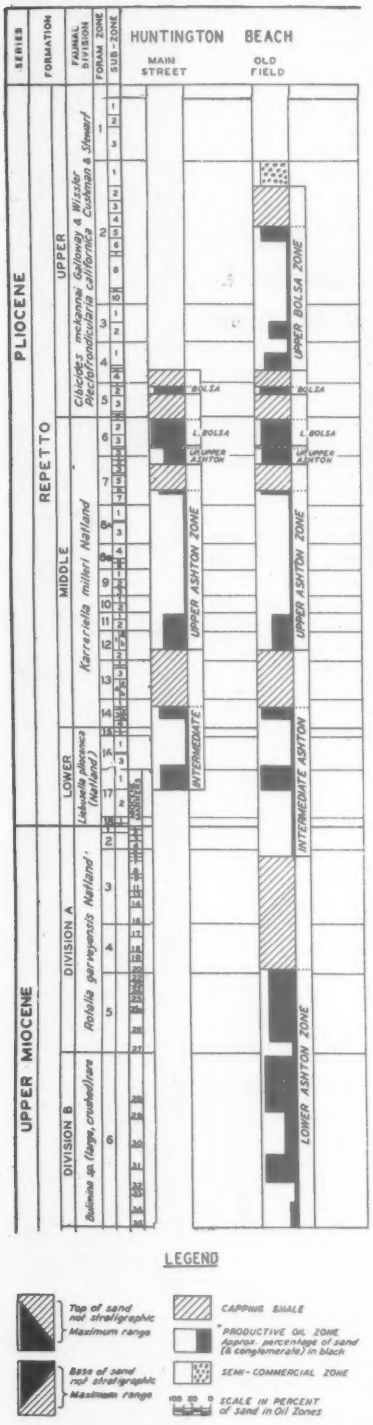


Fig. 4—Correlative chart for producing formations and sand content in oil zones. (From Wissler[2])

The oil represented production from tidelands property of the state, and the interests finally were adjudicated by October 1934 with the operators making settlements and signing sliding-scale royalty agreements with the Division of State Lands.

Fig. 5—Surface equipment for each group of five wells is on a concrete mat. For servicing, the single pumping derrick can be moved on steel wheels along the imbedded steel rails to the proper spot over any well. Separators for each "Main Sand" well are alongside the units, each equipped with individual oil meters

Development of the Tideland Pool

Brightest spot in engineering and ingenious use of modern drilling and producing equipment has been in the development of the Tideland pool area, starting in 1938. The precisely deflected and oriented drilling which achieved uniformly spaced subsurface exposures of Jones and Main sands, has been shown schematically in Fig. 1. The Jones sand lies just below Pliocene-Miocene contact. In the Tidelands pool, both average about 650 ft. in thickness, the Jones and the Main sands each separated by a shale bed of approximately the same thickness.

Best example and largest operation in the Tidelands pool is the State lease of Southwest Exploration Co. The concern has completed 84 "under-ocean" wells. In this work special practices and techniques have been developed which result in being able to drill and put on production the wells, which in extreme cases have been purposely deflected as much as 62°, in a length of time very little in excess of normal operations.

TABLE 1—DATA FOR HUNTINGTON BEACH, CALIFORNIA'S FIFTH POOL IN RECOVERY

Huntington Beach New	1944 oil prod. (B/D)	Cumulative oil, 1-1-45	No. of wells		Per cent water	
			Flow	Pump	End of year	6 mos. increase
Offshore:						
Jones	8,343	3,424,731	35	7	0.4	0.1
Main	17,949	65,073,989		138	19.7	2.6
(Subtotal)	(26,292)	(68,498,720)	(35)	(145)		
Onshore:						
Main area and Tar zone	2,717	42,651,650	..	162	65.2	11.0
A-37 area	1,319	815,806	.	28	4.3	*1.3
(Subtotal)	(4,036)	(43,467,456)	.	(190)		
Total—"New"	30,328	111,966,176	35	335		
Huntington Beach Old						
Bolsa area:						
Tar Bolsa	915	1,947,553	1	7	29.2	11.9
Ashton, Upper	73,643	6,847,348	3	29	18.8	1.4
Ashton, Lower	72,799	8,285,113	10	27	19.7	2.6
Other areas:						
Tar Bolsa	1,406	214,382,913	..	51	69.3	1.3
Ashton	7,870		..	347	68.2	1.8
Total—"Old"	16,633	231,382,913	14	461		
Grand total, Huntington	46,961	343,349,089	49	796		

*Decrease. 2,200 surface acres — Production to date, 156,089 B/A — Reserves about 175,000,000 bbl.

In commencing the under-ocean operations a choice was available of either constructing a large number of heavy piers out into the water and drilling and producing straight-hole wells at the end of the piers, or conducting the operations from onshore locations and using directionally slanted wells. Extreme cost of the piers and attendant maintenance and operational problems through the years economically favored the onshore choice. A long narrow surface lease paralleling the shore was obtained, and all drilling and producing activities and equipment have been concentrated there, in a neat straight row.

Well sites are generally grouped in units of five. In Fig. 8 is shown a pumping derrick which has just been erected over the first well completed of a new group, while a few feet away is a rig drilling the second location. Surface equipment for each group of five wells is placed on a concrete mat into which two parallel steel rails are imbedded. Along these rails a single pumping derrick is mounted on wheels. It can be moved back or forth over the rails to any particular well when pump or other servicing operations for that location comes up. Closeup view of the steel rail and wheeled derrick arrangement is shown in Fig. 5 for one group of wells, and many other groups lay directly behind.

In the Main sand, which has a very "open" character, with permeability of 1 to 2 darcys and porosity averaging 35 per cent, at least half of the wells are drilled in without the return of circulation. Oil is pumped during this process, during the course of which as much as 12,000 to 14,000 bbl. are lost (or rather, injected) to the producing formation. During this period it has been found imperative to keep the drill pipe moving at all times.

About 50 per cent of the wells, because of the "slant," were electrically logged through the drill pipe and weighted sinkers were attached to the electrodes to lower them to bottom position.

Before starting a new well, a course plan of the well bore is submitted to the Division of State Lands for approval. Ordinarily, with eliminating the drill collar and applying the proper weight, it has been found fairly easy to pitch or deflect the hole at the predetermined point and to follow the desired course, using directionally set whipstocks at intervals. Directional angle well-survey recordings are taken every 50 ft. Touch and experience developed in the past drilling enables a well to be completed, on the average, with only about five oriented whipstock settings, and usually the final course survey is found in very close coincidence with the planned construction. Casing program is to cement an 8⅝-in. water string on top of the sand, and on a liner-hanger suspend 6⅝-in. slotted pipe through the formation. Dual completions are not made.

How satisfactorily slanted wells

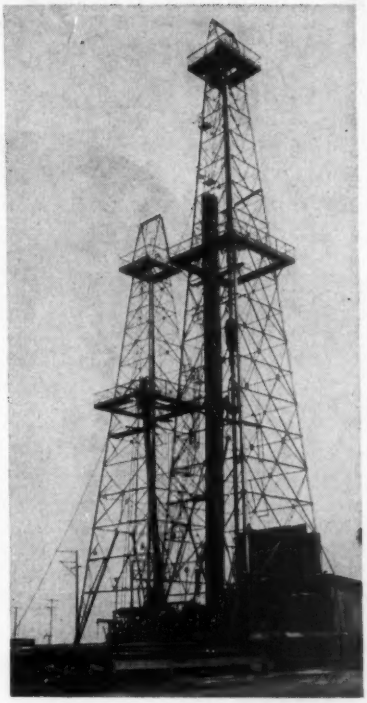
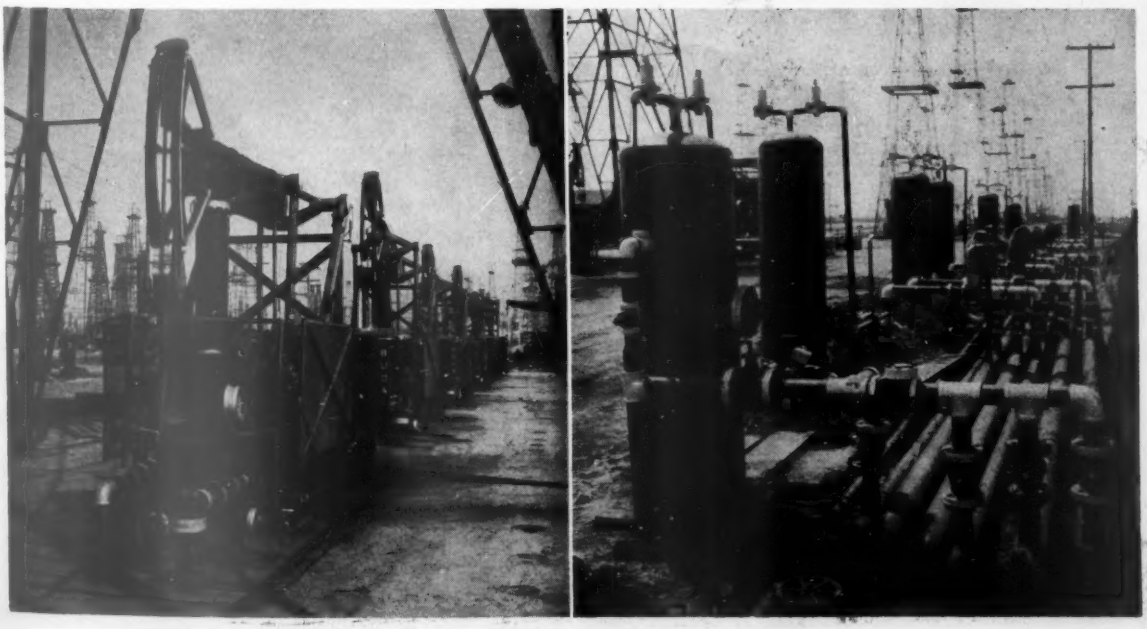


Fig. 8—In developing the off-shore lease, Southwest Exploration Co. has kept one to two rigs busy since 1938. Here a new group of five wells is in the making. At left, the pumping derrick (wheel and rail type) is running tubing on a new completion. To the right a few feet, second well for the group is drilling

Fig. 6 (Left)—All of Southwest Exploration Co.'s wells, directionally drilled to produce from their state lease under the ocean, are pumped by carefully counterbalanced individual units. The surface locations, only a few feet apart, stretch out in a neat straight row ⅞ mile long. Fig. 7 (Right)—Separators for each Jones sand well are adjacent to the series of pipe-line systems. These include oil, fresh and waste water, casinghead, and residue gas. A long lease road divides the wells from the pipe lines



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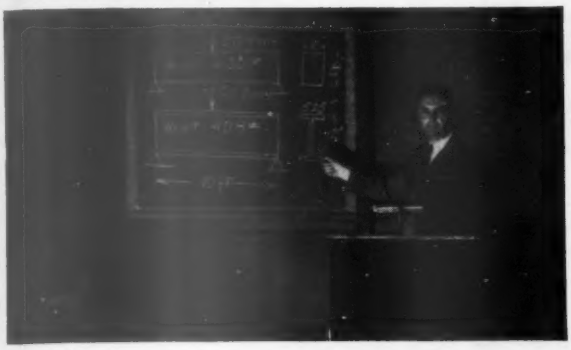

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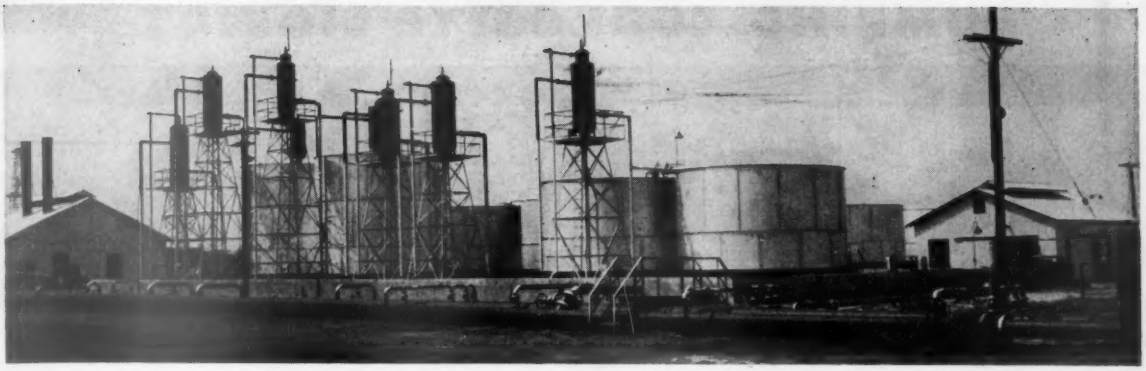

Fig. 9—One of the two central storage batteries operated by Southwest Exploration Co. at Huntington Beach. There are two 1,000-bbl. wash tanks (to 140° F. with steam coils), eight 2,000-bbl. stock tanks. Production and test separators are elevated. Heaters in fore ground are for the different oil and casinghead gas systems

perform on the pump, and questions as to frequency of pulling and severity of rod cutting and tubing-to-casing wear, naturally are among the most interesting subjects in reviewing the under-ocean operation. Many a statement and much discussion have been made in the past concerning seriousness of the aforegoing factors. Probably most of the past studies and findings have been particularly applicable to special circumstances such as corkscrewed holes, presence of concentrated or sharp bends, and other such clearly undesirable features. The results obtained at Huntington where fairly high rates of pumping (200-400 bbl. per day per well) prevail in well bores which have the deviated angles rather uniformly distributed, bring a new aspect to this questionable phase of pumping.

The usual subsurface equipment employed is a straight ¾-in. string of sucker rods run in 2½-in. external upset tubing, with the pumps in some cases being set close to bottom. Insert-type pumps of 1⅛ to 2-in. diameter are used. A condensed list of the pumping operations and results is:

1. First producing well, 1 State, was put on the pump December 18, 1938, and has never been pulled.

2. All 53 wells in the Main zone have been completed and placed on the pump since 1938. The majority have never been pulled except for the taking of bottom-hole-pressure measurements.

3. All of the 31 wells producing from the Jones sand are flowing except for 8 pumpers, and to the latter the performance status of 2 applies.

4. Since commencement of the 61 pumping operations there have been only two polished-rod failures and two rod partings.

5. In all of the pumping wells a total of not more than 200 ft. of tubing has been replaced. Neither rod nor tubing guides are used.

The operator attributes much of the satisfactory subsurface pumping equipment service to careful counterbalancing of the pumping units, of which a closeup view is given in Fig. 6.

A requirement of the offshore leases is that the oil and gas from each well be measured separately, so that accounting on the sliding royalty scale can be applied according to the producing rate of each well. In the case of the Main sand wells, individual separators are located immediately adjacent to the pumping units, as was shown in Fig. 5. After separating oil and gas, the oil passes through a displacement meter connected to the dump valve, then the oil and gas are sent through different lines to one of the central separation and storage batteries.

About 50 ft. from the line of pumping units are paralleling pipe lines which carry oil, fresh and waste water, casinghead and residue gas. Separators for each of the Jones sand wells are set at points close to these systems (Fig. 7). From each separator the oil volume is measured by a displacement meter, the gas by an orifice meter, as shown in Fig. 10. At the central separator-storage areas (there are two) a second stage of separation takes place at 40 psi., and the remaining gas released from the crude is measured. Measurements are also made for total oil and gas volumes.

Tallies between the measurements of the oil and gas volumes of individual wells and the totals gaged at the two central gathering areas have checked remarkably close, the overall volumes for amounts running into hundreds of thousands of barrels of oil and millions of cubic feet of gas coinciding to within less than 1 per cent. One of the two central batteries on the property is pictured in Fig. 9.

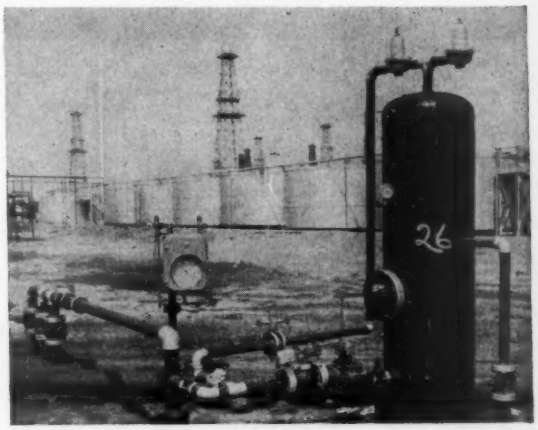

Fig. 10—Arrangement of equipment by which the production from each Jones sand well is separated, the oil and gas streams measured, then sent on to central storage and processing

So that close contact and supervision is had with the drilling and producing operations at all times, operating offices are located right in the center of the property. Unquestionably much of the efficient development and handling of the property can be attributed to the alertness and informed engineering which this on-the-spot system provides.

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1. Huntington Beach Oil Field-Old Field Portion," J. T. Carriel, 28th Ann. Report California Div. of Oil and Gas, June 1942

2. "Stratigraphy Formations of the Producing Zones of the Los Angeles Basin Oil Fields," S. G. Wissler, California Div of Mines, Geol. Branch, Bull. No. 118 (1943).

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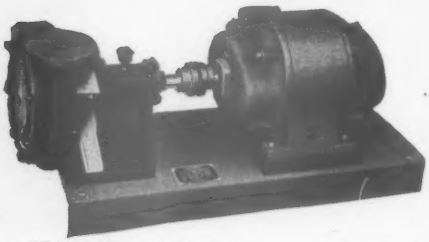
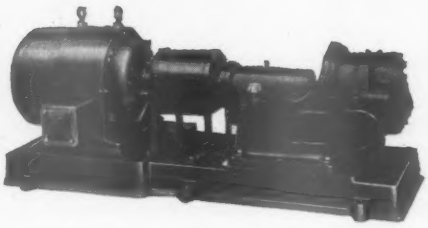
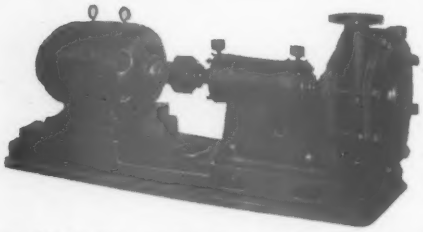
PUMPING CORROSIVE LIQUIDS



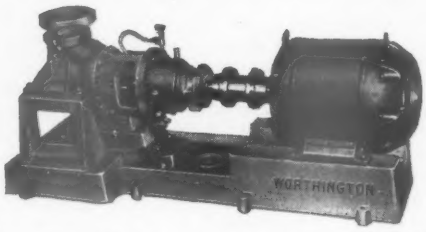
Type CG Worthite centrifugal pump . . . open impeller . . . capacities to 3000 GPM . . . heads to 150 ft. Bulletin W-350-B1F.



Type HBLC Worthite centrifugal pump . . . vertically split . . . capacities to 240 GPM . . . heads to 540 ft.



Type CQ Worthite centrifugal general-purpose pump . . . capacities to 600 GPM . . . heads to 130 ft. Bulletin W-350-B3F.



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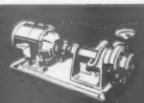

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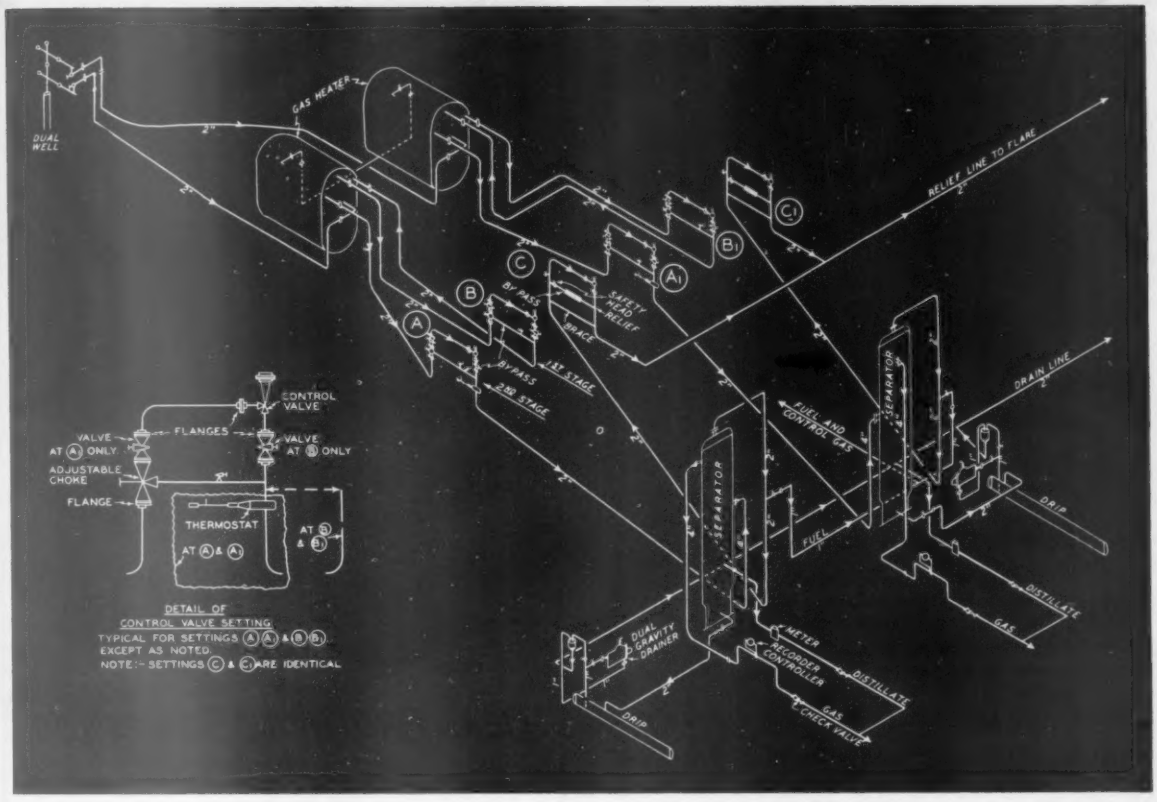


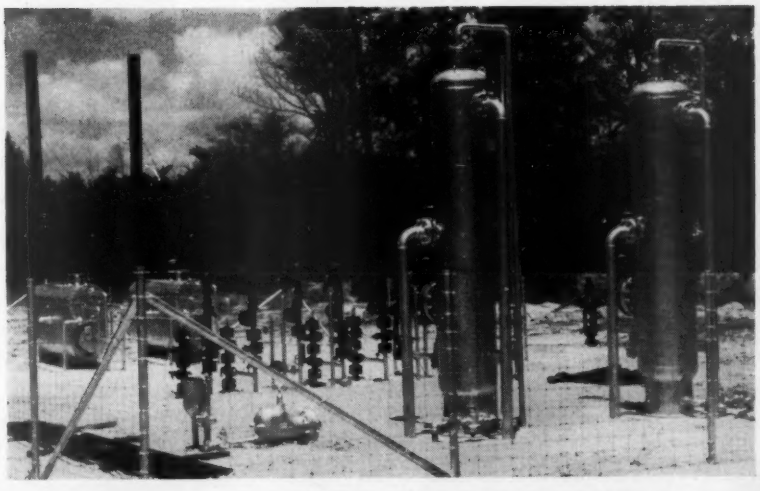
Flow diagram for pressure-reduction and metering installations at Arkansas-Louisiana Gas Co.'s gas-distillate wells in Carthage field, Panola County, Texas. Diagram shows twin hook-up for dually-completed wells

Close Control of Gas Pressure Achieved In Carthage Field Metering System

by Neil Williams

INSTALLATIONS being provided by Arkansas-Louisiana Gas Co. for production of its gas-distillate wells in the Carthage field, Panola County, Texas, are designed to make possible exceptionally close, yet flexible control of pressure reduction, and measurement of gas and metering of distillate at predetermined uniform temperature under variable volume conditions. Through them, not only is effective separation of gas and distillate attained for metering purposes, but the need for exercise of temperature correction factors in computing volumes is avoided, and the procedure of gas-measurement simplified.

One of these installations is presented in the accompanying flow diagram and pictures. The general layout and hookup are being standardized for all of this company's



Dual well production control installation as shown in accompanying flow diagram. In center are control valve settings. On ground at side of separators are the dual-gravity automatic drains

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PLANTATION PIPELINE COMPANY

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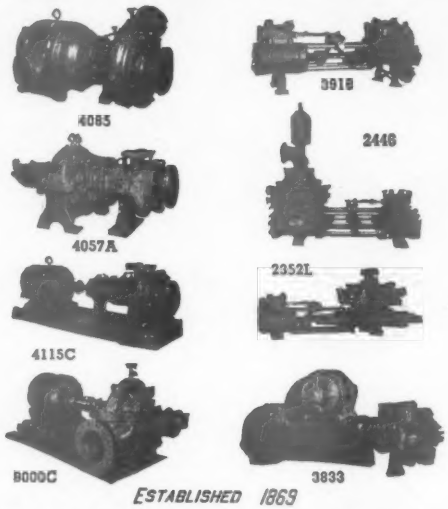

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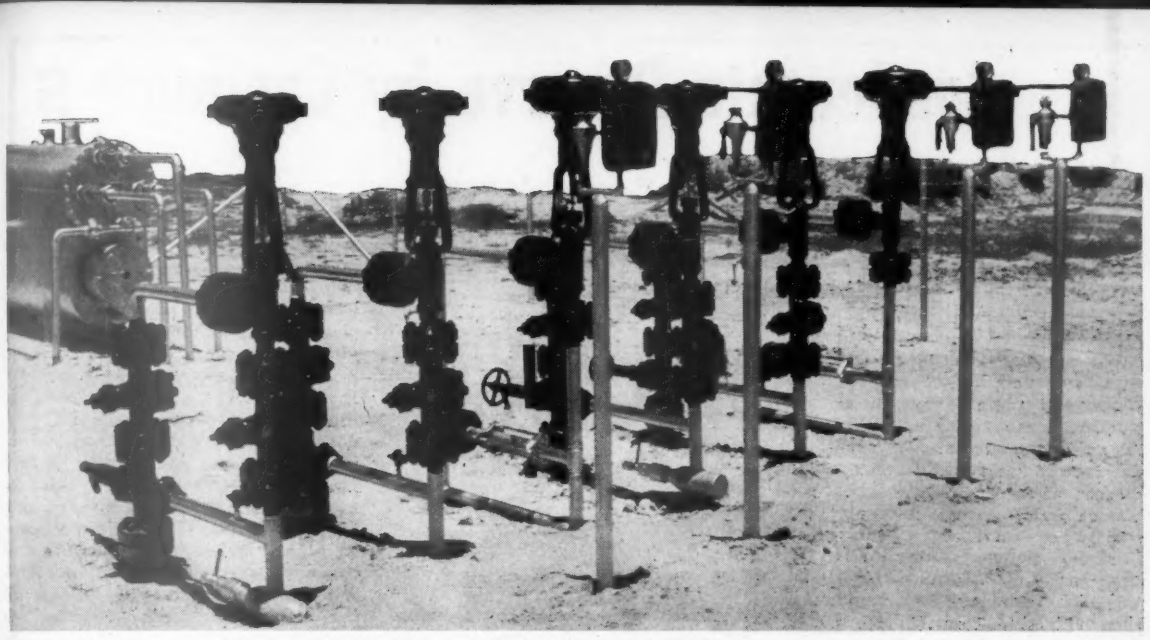

Pressure-control-valve settings. These correspond to the settings shown in the accompanying diagram. Thermostats for controlling gas temperature are shown on the down side (at ground level) of the second-stage pressure reduction control settings (first and fourth)

wells The one shown is for a dually completed well, and thus consists of two parallel duplicate systems, one for each of the well's two producing horizons. Each operates independently of the other as if for two wells at different locations, except that they supply a single fuel and control gas system and have common relief-gas and water-drain lines.

Pressure Reduction

Pressure reduction from the well to the separator is in two stages with the gas heated ahead of each reduction to counteract the refrigeration effect. Control valve settings for the first stage reduction in the two systems indicated in the diagram are at B and B-1, respectively, and for the second stage reduction at A and A-1. A 3,000-psi., angle-type motor-control valve is employed in each setting for the pressure reduction. This is set so that the gas flow is over and under the valve seat, which permits closing the valve with, instead of against well pressure, and which also tends to reduce cutting out of the valve.

The key pressure-control point is at the first-stage pressure reduction. At that point it is desired to hold a constant pressure on the downstream side to the second stage reduction regardless of the volumes handled or the pressures at other points in the system. The valve at that point is controlled from a differential pressure recorder and control setting at the orifice installation on the downstream gas line from the separator. With the controller recorder set to hold a steady volume of gas and maintain a fixed differential pressure through the orifice, any variation will react through the pressure line to the diaphragm of the control valve to open or close this valve to maintain the desired downstream pressure. In turn, by changing the differential pressure setting, the pressure drop at the control valve may be varied.

Operators are not concerned particularly with the pressure below the second-stage reduction as this will take care of itself and will vary according to the pressure in field lines to gas outlets and the differential pressure to be maintained at the recording controller. At present, the only outlet for the gas production, except for wells in the older part of the field which are supplying a low pressure gasoline plant, is for fuel under boilers at drilling rigs. This gas is being delivered at a pressure of less than 400 psi. and hence, the pressure from the second-stage reduction is dropped to from 400 to 435 psi. However, a gasoline plant to operate at a pressure of approximately 1,000 psi. will be constructed in the near future. With this taking the gas, pressure at the well will have to be stepped up to

(Continued on page 119)

Separator and metering installation. Distillate production is metered through displacement-type meters on the fluid dump line outlets of the separators. Gas is measured through the differential pressure recorder setting at the orifice fittings on the meter runs (background). The 1-in. line take-offs from the 2-in. overhead blow-off lines from the separators supply the heater fuel and control gas system. Photographs by J. E. Hampson, through courtesy of Arkansas-Louisiana Gas Co., Shreveport

XUM

Condensate Reserve by Cycling

*by Park J. Jones**

THE OPTIMUM RATE OF PRODUCTION

PART 10 OF A SERIES

OTHER things equal, the optimum rate of producing condensate by cycling depends on reserves, number of producing and injection wells, and size of plant required and operating expenses. Operating expenses increase significantly when dry gas breaks through into producing wells. Injection of dry gas more than once, recycling, is a total loss relative to injecting dry gas once, cycling. As cycling plants are usually operated at gas capacity, dry gas in production decreases the rate of condensate recovery. Compressors are loaded but the volume of liquid continues to decrease as the per cent dry gas in the production increases. Contamination of production by dry gas results primarily from not providing sufficient distance between injection wells and producing wells. If we double the distance between injection and producing wells, condensate recovery before contamination by dry gas is likely to be four times what it would be relative to a given distance. On the other hand, a barrel of reservoir space may contain only 0.02 up to about 0.2 bbl. of condensate. If we compare this with the 0.5 up to 0.99 bbl. of oil per barrel of reservoir space, we have a ratio of oil initially in place to condensate initially in place ranging anywhere from 5 to 25. By comparison, anywhere from 5 to 25 acre-feet of condensate pay are required to hold as many barrels as there are contained per acre-foot of oil pay. The economic and physical circumstances attending condensate reservoirs require comparatively long distances between producing and injection wells. The required distances can be provided under unit operations.

The Breakthrough Condensate Reserve

A CONDENSATE reserve for a given reservoir consists of the fraction recoverable before dry gas breaks through into producing wells and the fraction recoverable at declining producing rates after production is contaminated by dry gas. As operating expenses increase and the rate of condensate recovery decreases after dry gas reaches producing wells, we are interested primarily in maximizing condensate recovery before contamination by dry gas. Let U equal the breakthrough condensate reserve, that is, the barrels of condensate recoverable before contamination by dry gas. It can be shown that the breakthrough condensate reserve is defined by:

$$U = \frac{S}{b}(JI) \qquad (1)$$

where S is the barrels of reservoir space[1] occupied initially by retrograde gas; b is the volume factor[2] in barrels of space per barrel of condensate; J is the displacement factor[3,4] or fraction of condensate displaced from the region invaded by dry gas and I is the invasion factor[5] or fraction of reservoir space invaded at the time dry gas breaks through into producing wells. Equation 1 states that the breakthrough condensate reserve U is equal to the product of S/b the condensate initially in place and the displacement factor J and the invasion factor I. The condensate initially in place relative to a fixed plant recovery is not a controllable circumstance. But displacement and invasion factors are controllable.

*Production consultant, Houston.

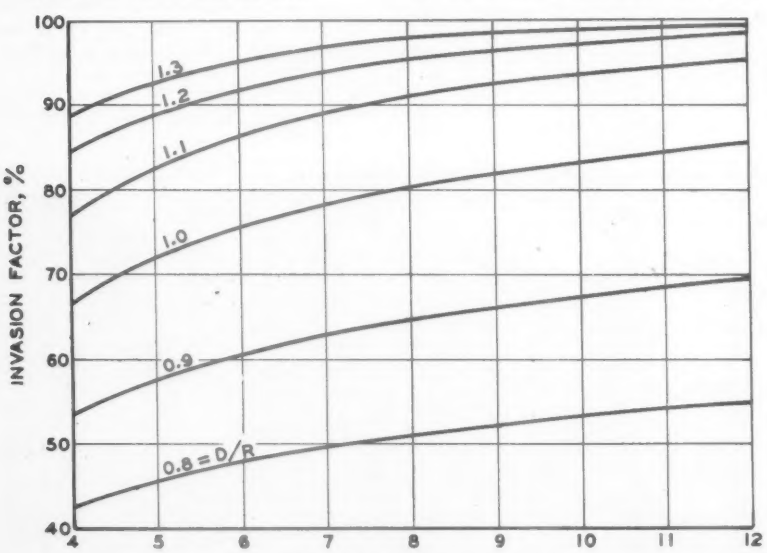

Fig. 10-1—Breakthrough invasion factors vs. number and location of injection wells uniformly spaced on a circle about centrally located producing wells

Breakthrough Invasion Factor

The numerical value of a breakthrough invasion factor for condensate depends on the distance between producing and injection wells, the shape of reservoirs, the distribution of pay thickness and the rate of injection into, and production from, individual wells. The number of possible conditions obtainable by varying the shape and size of reservoirs and distribution of pay thickness in combination with the number of producing wells, number of injection wells and the rates of injection into, and production from, individual wells is practically unlimited. Nevertheless, we would like to illustrate the effect of distance between producing and injection wells on the breakthrough invasion factor. For this purpose, we will consider an approximately circular reservoir having a uniform pay thickness. Under these conditions there is no sectional convergence or divergence of reserve.

Consider an approximately radial reservoir for which the radial dis-

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tance from the center of the reservoir to the initial productive limits averages R feet. Let the pay thickness be uniform and let N injection wells be located on a circle of radius D feet. Let producing wells be located at, or near, the center of the field. Finally, let the rate of injection be the same for all injection wells. Under these conditions the invasion factor or acre-feet of pay invaded by dry gas to the acre-feet of pay initially occupied by condensate is shown by the curves in Fig. 10-1. The invasion factor in per cent of the acre-feet to be invaded by dry gas is plotted against the number of wells uniformly spaced on a circle. The position of wells relative to initial productive limits is denoted by D/R. The radius of the circle on which injection wells are located is D feet. The average radius of a reservoir is denoted by R. The ratio D/R denotes the position of injection wells. A ratio of one means that injection wells are located at the productive limits of a reservoir. A ratio of 0.8 means that injection wells are located at 80 per cent of the radial distance to the initial productive limits, and so on for any other value of the ratio D/R. It might be of interest to tabulate some values.

Location of injection wells	0.8	1.0	1.2
No. of injection wells	Breakthrough invasion factor, per cent		
4	42.5	66.5	84.0
6	47.5	75.0	91.5
8	51.0	80.0	95.0
10	53.0	83.0	97.0
12	55.0	85.5	98.5

The foregoing data are relative to producing wells grouped about the center of a reservoir. If the distance from the center to producing wells were 10 per cent of the distance R, a 1 per cent correction would be applied to the data in Fig. 10-1. A 4 per cent correction would be applied if the distance from the center to producing wells were 20 per cent of the distance R, and so on for any other location of producing wells. Aside from corrections for producing wells not located in the center, we note that the invasion factor increases faster with distance than with the number of wells. Four injection wells located at 1.2 have a higher invasion factor than 12 injection wells located at 0.8. Other things equal, the breakthrough condensate recovery relative to 12 injection wells located at 0.8 is as the ratio of 84/55 or 153 per cent. At least a 53 per cent higher breakthrough recovery is possible with 4 injection wells than with 12 injection wells provided the four injection wells are located far enough from producing wells.

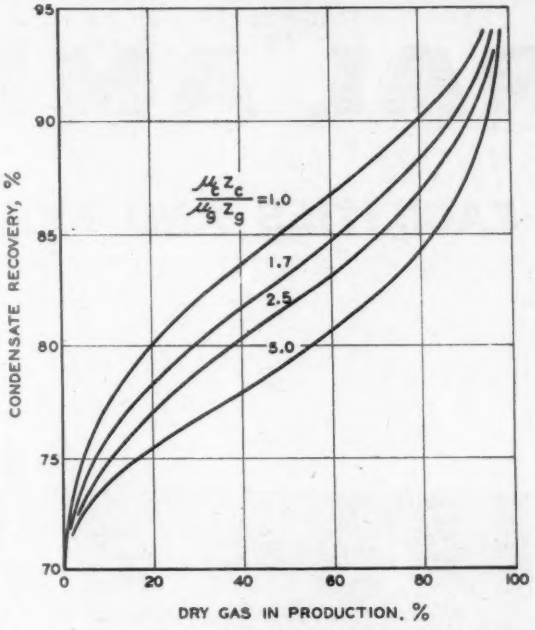

Fig. 10-2—Per cent condensate recovery from a section of pay vs. per cent dry gas in the production from the section and viscosity-compressibility ratios; tentative data subject to revision

Displacement of Condensate by Dry Gas

Other things equal, distances between sources of gas and producing wells determine the acre-feet of condensate pay invaded by dry gas. The ratio of invaded acre-feet to the acre-feet to be invaded is the invasion factor. But the invasion factor defines only the region invaded by gas. It does not tell us how much condensate is displaced from the invaded region. The condensate recovery from invaded regions depends on the displacement factor.

The basic data for evaluating displacement factors are shown in Fig. 10-2. Condensate recovery from a section of pay in per cent of the condensate initially in place is plotted against the composition of the production from a section. Composition is expressed as per cent dry gas in production. Displacement of wet gas by dry gas from a section depends on the properties of the wet gas in place and on the properties of injected dry gas. The pertinent properties are the viscosities and the compressibility factors. The ratio μ_c/μ_g of the viscosity of the gas in place to that of dry gas times the ratio Z_c/Z_g of the compressibil-

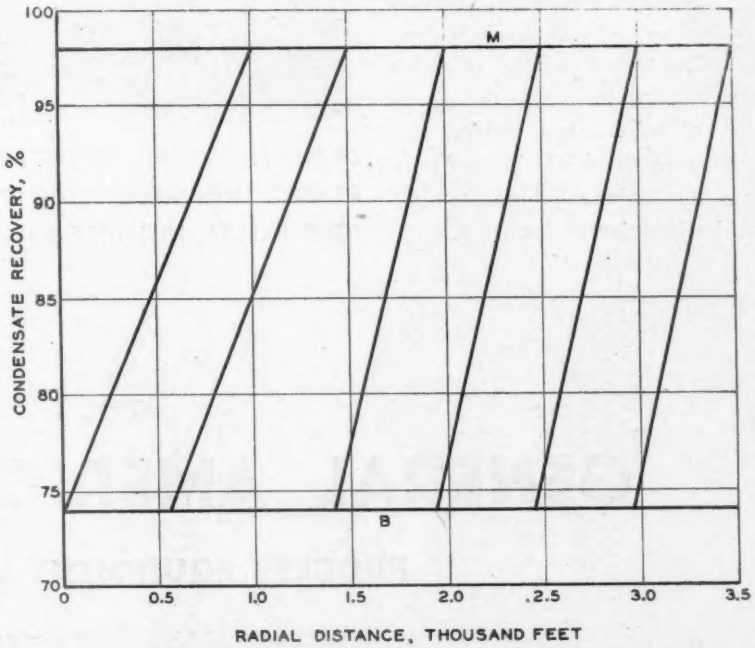

Fig. 10-3—Illustrating the updip displacement of an average condensate by dry gas in radial reservoirs having no sectional convergence; dry gas advances from right to left; condensate recovery from any section in per cent of the condensate initially in place; source of dry gas is 3,500 ft. from center of reservoir

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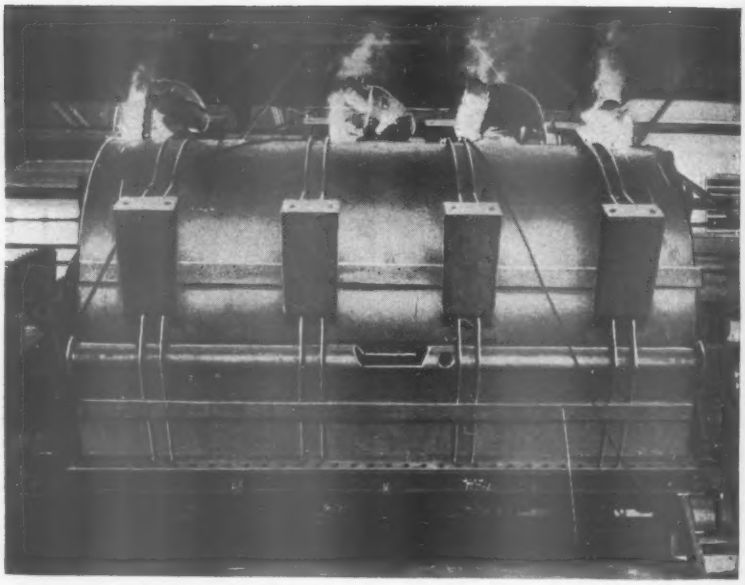

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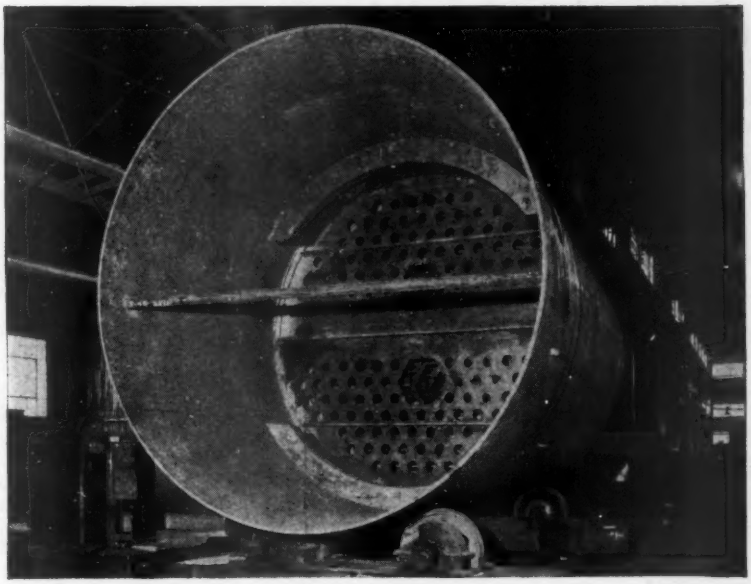

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ity factor of the gas in place to that of dry gas is called the fluid factor for condensate. The fluid factor F for condensate is equal to the product of viscosity ratio and compressibility factor ratio, that is:

$$F = \frac{\mu_c Z_c}{\mu_g Z_g} \quad . \qquad (2)$$

Other things equal, condensate recovery from a given section of pay depends on the fluid factor. The curves in Fig. 10-2 shows the probable variation of condensate recovery from a section with fluid factors. Suppose we force dry gas into a section of pay. The breakthrough displacement of condensate for about 2 or 3 per cent dry gas in the production from a section is about 74 per cent of the condensate initially in place provided the fluid factor is less than 2.0, this is, provided the condensate content is on the order of 50 bbl. per million cubic feet of gas or less.

As we force more gas into a section of pay, the condensate recovery from the section continues to increase. As the composition of the production from a section approaches 100 per cent dry gas, the condensate recovery probably is on the order of 98 per cent provided the gas in place is not too rich. A 98 per cent condensate recovery is about the upper limit of condensate recovery from a section. If we force still more dry gas into a section, the position of the section of maximum recovery advances downstream.

Field studies based on the increase of dry gas in production indicate a lag on the order of 500 ft. between the sections of breakthrough and maximum recoveries, provided the fluid factor is not too high and there is no sectional or areal convergence or divergence. Comparatively high fluid factors decrease the breakthrough recovery and the maximum recovery and increase the distance between the sections of breakthrough and maximum recoveries. The effect of sectional and areal convergence is to increase the distance between the sections of breakthrough and maximum condensate recoveries. These points will now be illustrated by an example.

Breakthrough Displacement Factor

Consider an approximately circular condensate reservoir. Let the distribution of pay thickness and porosity be uniform. Under this condition, there is no sectional convergence or divergence of the condensate ultimately recoverable per foot of horizontal distance. There is, however, an areal convergence of condensate recovery in going from the productive limits toward the center of the reservoir. Suppose the radial distance to the initial position of the productive limits averages 3,500 ft. Let injection wells be located at 1.0, that is, at the initial position of the productive limits.

Under these conditions, the displacement of an average condensate from the region invaded by dry gas would be defined approximately by the lines in Fig. 10-3. Condensate recovery in per cent of the condensate initially in place is plotted against radial distance. The lower horizontal line B represents the 74 per cent breakthrough recovery. The upper horizontal line M corresponds to the 98 per cent maximum recovery. Injected dry gas advances from right to left. The distance between the sections of breakthrough and maximum recoveries increases as the center of the reservoir is approached. This distance for the present conditions is defined approximately by:

$$B = (M^2 - 1{,}000M)^{0.5} \qquad (3)$$

where M is the position of the section of maximum recovery relative to B the position of the section of breakthrough recovery for updip displacement of condensate in a radial reservoir having a uniform pay thickness.

The recovery to the right of the section of maximum recovery is on the order of 98 per cent. The recovery from the interval between B and M ranges from about 74 up to about 98 per cent. The areal average for this interval is 90 per cent for B equal to zero and 86 per cent for large values of B. It follows, therefore, that the condensate displacement factor is probably higher than 90 per cent for most reservoirs except those containing an unusually rich gas and those in which retrograde condensation occurs. In other words, the condensate recoverable from most reservoirs before dry gas breaks through into producing wells depends primarily on the distance between injection wells and producing wells, that is, on the invasion factor rather than on the displacement factor.

Need for Unit Operations in Cycling

The data shown in Fig. 10-3 are for a section along a radial line. On a plan view, the region invaded by dry gas varies approximately as the square of the distance advanced by dry gas. Other things equal, the breakthrough condensate recovery is multiplied by four if the distance between producing and injection wells is doubled.

The comparatively small condensate content per acre-foot is another reason for the need of comparatively long distances between producing and injection wells in cycling. The usual oil reservoir contains anywhere from 0.5 up to 0.99 bbl. of oil per barrel of reservoir space. On the other hand, the condensate content usually falls between 0.02 and 0.2 bbl. per barrel of space. By comparison, anywhere from 5 up to 25 acre-feet of condensate pay are required to equal 1 acre-foot of oil pay from the viewpoint of barrels of condensate initially in place.

Optimum rates of cycling require comparatively long distances between injection wells and producing wells in order to payout producing wells, injection wells, compressors and absorption plant. The comparatively long distances are also required in order to achieve reasonable condensate recoveries prior to excessive contamination of dry gas. The required distances can be provided under unit operations.

References

1. The Oil and Gas Journal, Nov. 4, 1944, p. 53.
2. The Oil and Gas Journal, Feb. 3, 1945, p. 51.
3. The Oil and Gas Journal, May 19, 1945, p. 128.
4. The Oil and Gas Journal, May 26, 1945, p. 139.
5. The Oil and Gas Journal, June 2, 1945, p. 97.

Electrical Device Forecasts Future of Oil Fields

PITTSBURGH. — An electrically operated device designed to save vast quantities of oil that otherwise would not be recovered, has been perfected by Gulf Oil Corp. technicians. Gulf scientists have experimented with the invention, called the Electrolytic Modern Oil Field, at Harmarville, near here.

A company statement says the instrument, which represents an oil field in miniature "will substantially increase the world's usable oil resources, by assuring a greater percentage of oil recovery."

The model, which can represent a field of up to 20 wells, is about the size of a home workbench and is described as able to forecast a given oil field's future for 20 years in no more than 3 hours.

The operator sets up small tubes to represent wells in the same relation and at proportionate distances as in a given oil field and connects them with an electrically sensitized mat.

Spread of current through the mat shows how water, gas, or oil would spread beneath an actual oil field.

Maximum oil extraction may be achieved, because the model gages exactly how water-flooding or gas-injection operations may be conducted without blocking off part of the oil reserve from the wells. Water and gas-injection plans heretofore have been based primarily on estimated porosity and saturation of the sand.

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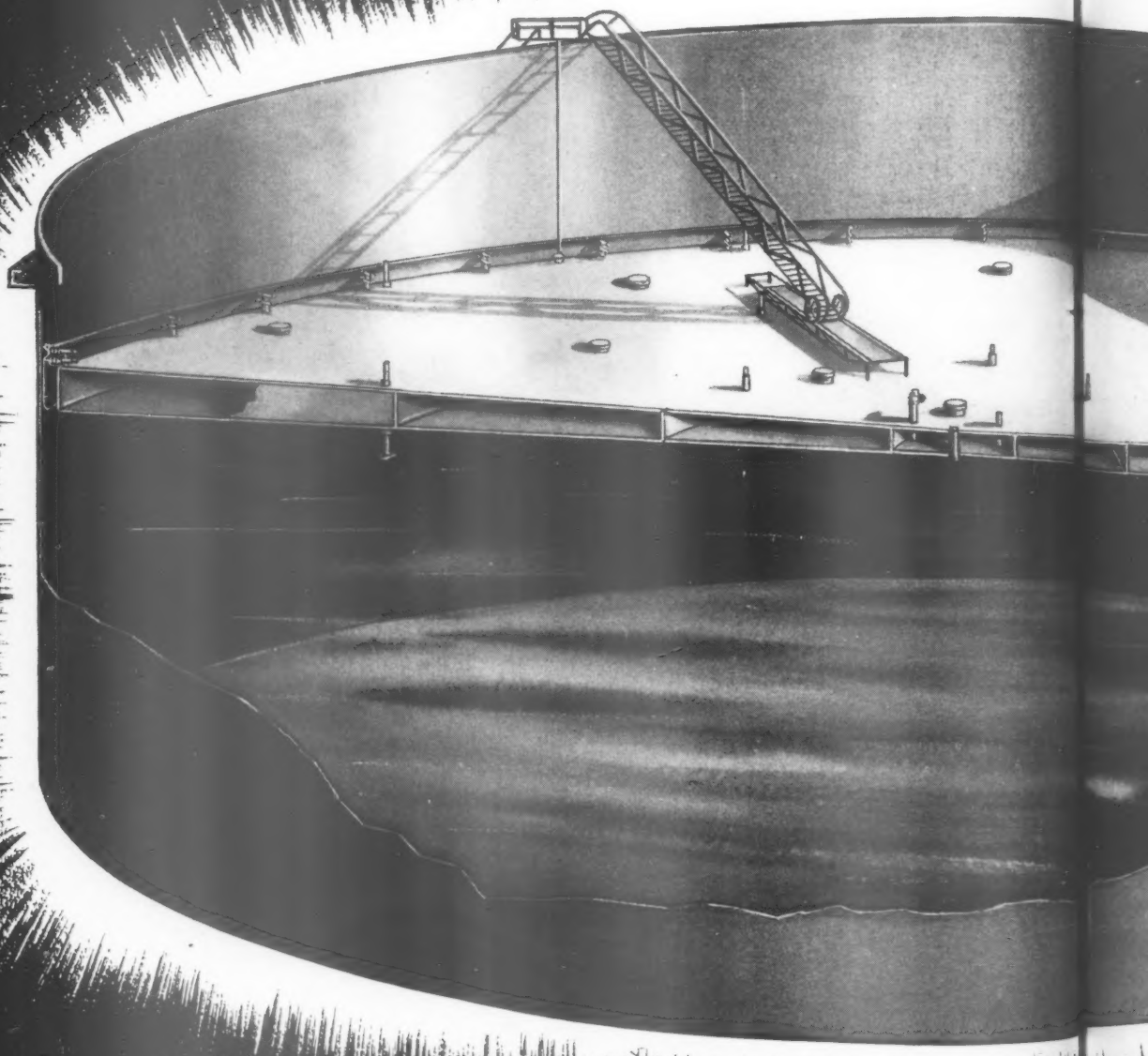

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- Entire bottom of deck is in contact with liquid, reducing corrosion.
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- Deck drains rapidly to screened opening at center. Water collecting on the roof when drain is closed does not lessen stability.
- Open sump draining rain water into tank, pipe drain or flexible hose optional. No siphon necessary with open sump.
- Bottom of deck coned up to center, facilitating the venting of air trapped under deck when roof is floated or the collecting of entrained vapors which are held until they recondense.
- Top of deck smooth and free of obstruction.
- Space between deck and tank shell closed by effective seal which forms a long sliding contact with tank shell. Secondary seals supplied when product stored requires added protection.
- Installed complete with adjustable supports, gauge hatch, bleeder vent, drain, emergency drain, and manholes.
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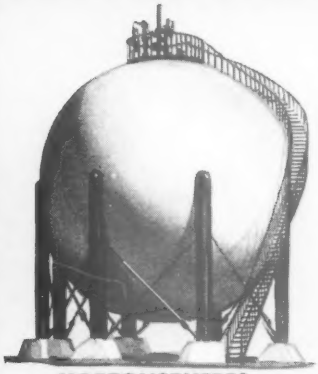
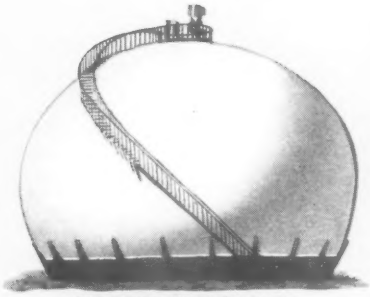
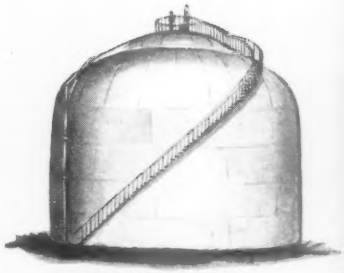


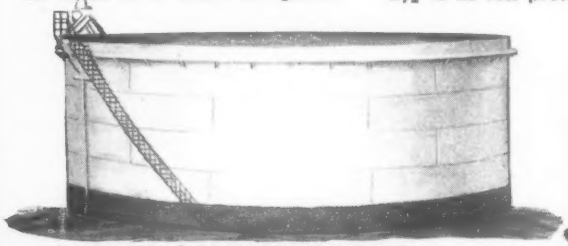
HORTONSPHERES . . . are used by the petroleum industry for the storage of highly volatile liquids and gases. They prevent evaporation loss by allowing pressure to build up inside the tank instead of venting. Hortonspheres are available in standard capacities from 1,000 to 20,000 bbls. for liquids, and from 20 to 65 ft. in diam. for gases.



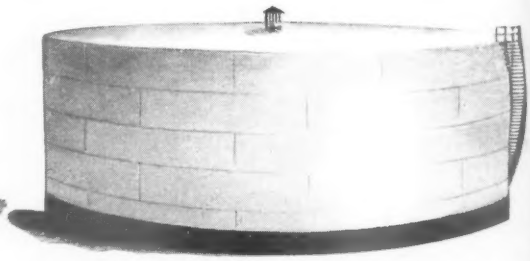
HORTONSPHEROIDS . . . are large capacity pressure tanks for storing hydro-carbons ranging in volatility from motor fuel to natural gasoline. Smooth Hortonspheroids are built in capacities of 2,500 to 40,000 bbls. for pressures from 2½ to 35 lbs. per sq. in. and noded designs from 20,000 to 120,000 bbls. for 2½ to 20 lbs. pressure.



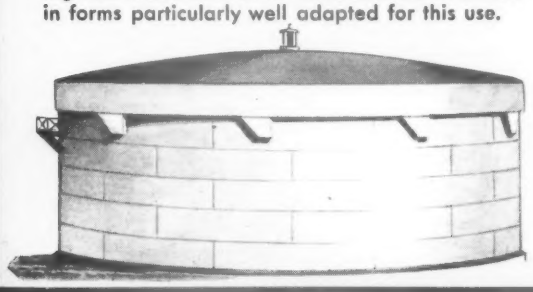
HEMISPHEROIDS . . . provide an economical means of storing liquids that are only slightly volatile, requiring pressures of only 2½ to 10 lbs. per sq. in. to stop standing storage losses under normal operating conditions. Built in sizes from 2,500 to 20,000 bbls. (Noded Hortonspheroids are used for capacities over 20,000 bbls.)



WIGGINS* FLOATING ROOFS . . . are supplied for installations where the volatility of the oil does not require the insulating qualities of the Horton roof. These roofs, in varying specific forms, have been used extensively on tanks storing sour crude oil and will hereafter be available in forms particularly well adapted for this use.



WIGGINS BREATHER* ROOFS . . . are used to reduce breathing losses on standing storage tanks. They are particularly recommended for tanks 60 ft. in diameter or larger that are kept full or nearly full most of the time.



HORTON LIFTER ROOFS . . . reduce evaporation losses from standing storage or slow working tanks. The vapor spaces of several adjoining cone roof tanks are often connected to the vapor spaces of a tank with a lifter roof.

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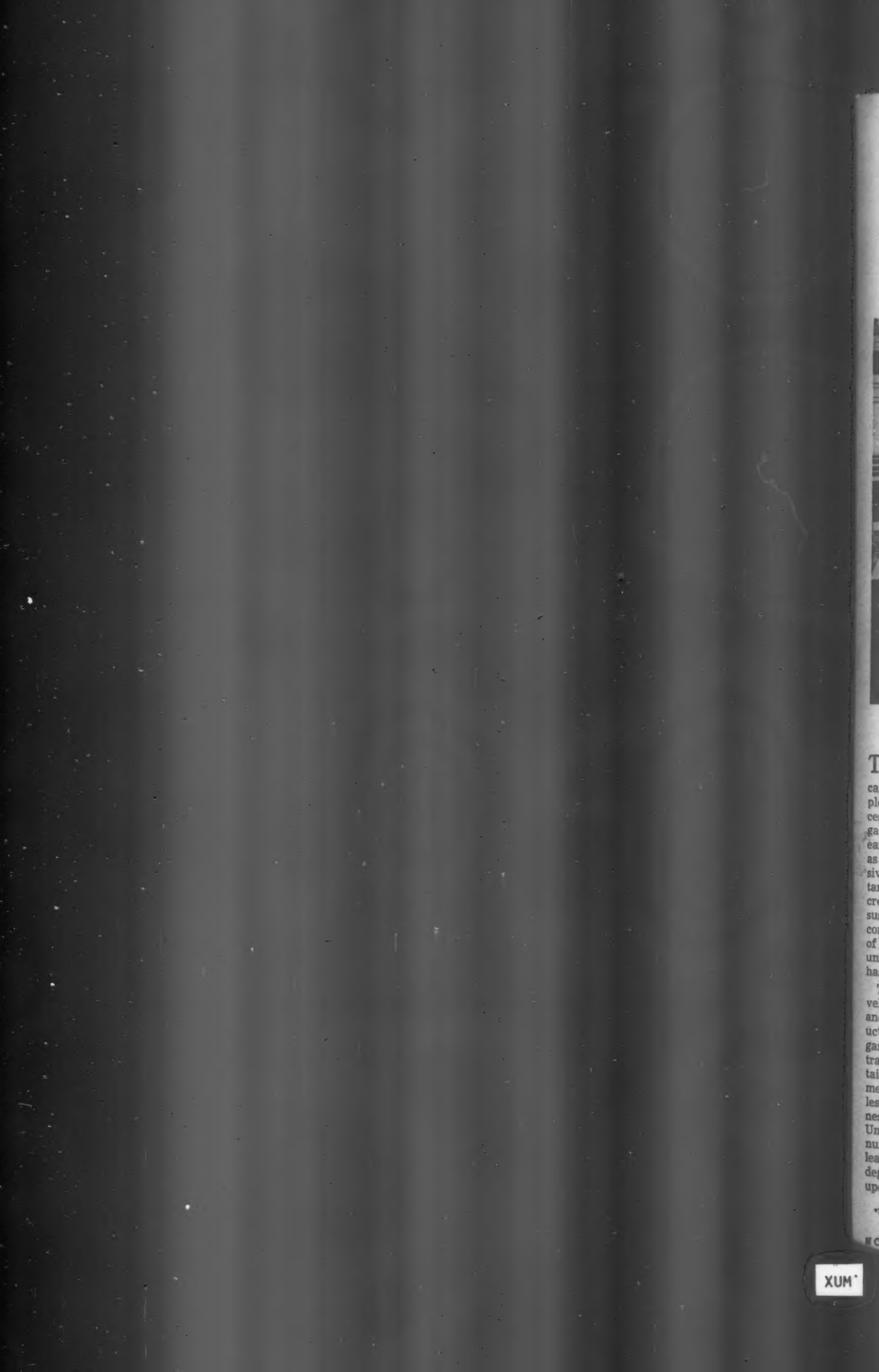
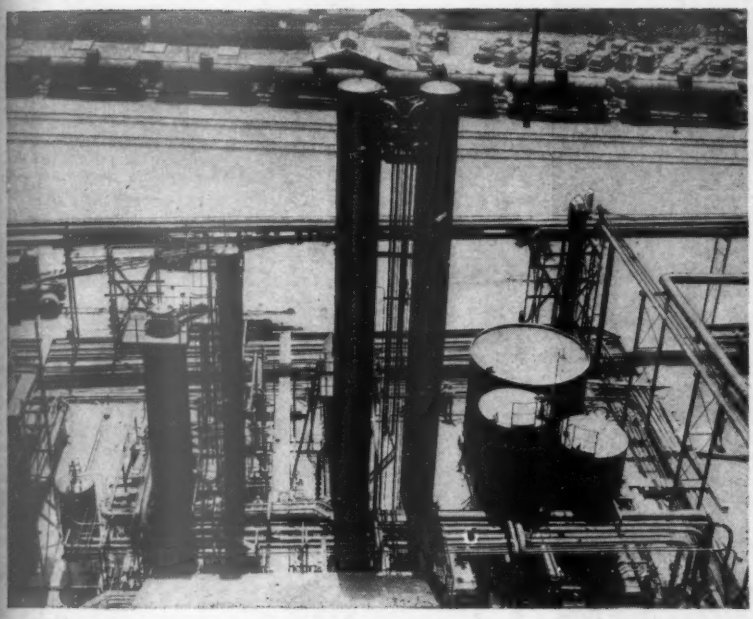


Unisol Process Improves Octane Number and TEL Susceptibility

*by C. D. Lowry, Jr., and F. C. Moriarty**



A West Coast unit which simultaneously processes two feed stocks

Several years' experience with this process has shown that it eliminates entirely the greater proportion of mercaptan sulfur present in motor fuels, the authors say. Clear octane number is improved slightly or remains the same as before treatment. TEL susceptibility of the treated gasoline is improved importantly, and in proportion to the amount of sulfur removed.

THE two newest and largest Unisol plants, for the removal of mercaptans from gasoline, have completed more than 1½ years of successful operation. The experience gained in these plants and from three earlier units establishes the process as a simple, effective, and inexpensive means of eliminating mercaptans from gasoline, and thereby increasing octane number and lead susceptibility. All five of these units continue to be an important part of the refinery operation. Four other units are under construction and one has just recently gone on stream.

This process, originated and developed by Atlantic Refining Co., and licensed by Universal Oil Products Co., extracts mercaptans from gasoline by contact with a concentrated solution of caustic soda containing methanol. The removal of mercaptans from gasoline, regardless of its nature or degree of sourness, is substantially complete. By Unisol treating, the clear octane number is usually increased and lead susceptibility is improved, the degree of improvement depending upon the quantity of mercaptans originally present. Operating costs are low, approximating 1 to 1½ cents per barrel for chemicals and utilities, depending again upon the amount of mercaptans to be removed.

The process has notable advantages over sweetening methods. It is superior to the use of caustic soda alone in that it removes all but minute traces of mercaptans from any gasoline whereas caustic alone is effective only in the removal of lower-boiling mercaptans. It is superior to sweetening by doctor solution or the action of copper salts because the mercaptans are taken out of the gasoline and not simply converted into disulfides, which are just as harmful to lead susceptibility as are the original mercaptans. This process also avoids the ever-present danger in doctor sweetening that harm to octane number and inhibitor susceptibility will occur because of accidental use of excess sulfur, and the danger that harm to gum stability will occur by traces of copper remaining in gasoline after copper sweetening. In other words, this process cannot affect the gasoline quality in any way except to improve it.

As compared to other mercaptan extraction processes, the Unisol process has several points of superiority. Since the substance used to increase the solubility of mercaptans in the caustic phase is a volatile material—methanol—it is separated from the caustic during each regeneration. The caustic may therefore be replaced without any difficulty, should this become desirable owing to the accumulation of undesirable impurities such as sulfides, salts of fatty acids, naphthenic acid, or possibly phenols when treating certain highly phenolic stocks, although phenols do not reduce the extraction efficiency of the reagent. In other mercaptan extraction processes, great diligence must be exercised to prevent contamination of the reagent, as purification of the reagent and recovery of the expensive material used to improve mercaptan solubility are difficult or impractical.

The two new plants referred to in the first paragraph are those of Union Oil Co. of Wilmington, Calif., and Cities Service Oil Co. of Lake Charles, La. Unisol plants now in operation, their daily capacities and locations are :

	Bbl.
Cities Service Oil Co., Lake Charles, La.	25,000
Union Oil Co., Wilmington, Calif.	*12,000
Standard Oil Co. of Calif., Richmond, Calif.	12,000
Delta Refining Co., Memphis, Tenn.	600
Big West Oil Co., Kevin, Mont.	600
Johnson Oil Co., Cleveland, Okla.	1,700

*At present only 5,000 bbl. per day of this capacity is being utilized. Provision was made in design of the regeneration section for future installation of another extractor capable of treating 7,000 bbl. of gasoline.

These plants, which serve the needs of both large and small refineries, are processing gasoline of

*Universal Oil Products Co.

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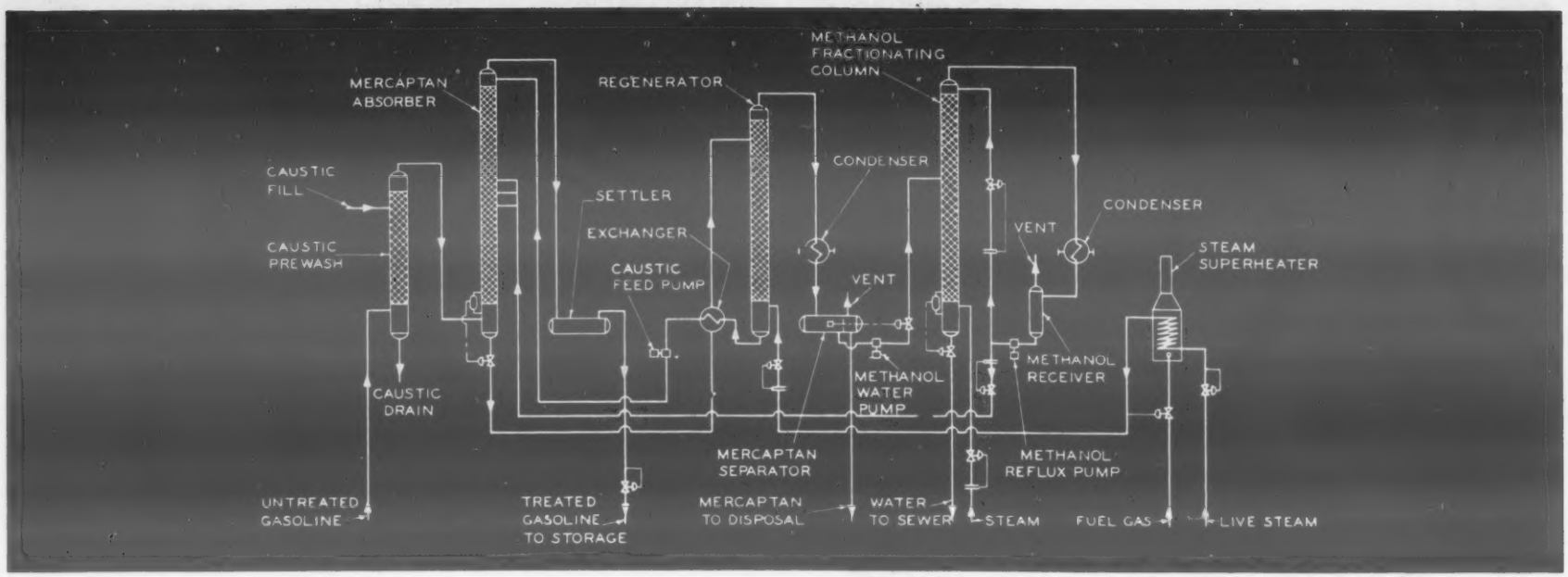

Fig. 1—Flow of gasoline and treating agents through a Unisol plant

TABLE 1—UNISOL TREATING RESULTS FROM COMMERCIAL UNITS

Source of crude† and type of gasoline treated	Oklahoma		Los Angeles Basin—Blend of reformed and cracked gasoline				Santa Maria—Viscosity breaker gasoline		Mixed California—Blend of cracked and reformed gasoline		Gulf Coast and East Texas—Cracked gasoline		Montana—Cracked gasoline		Mid-Continent—Cracked gasoline	
Boiling range, °F.	100-400		130-240		135-390		80-290		130-261		135-355		100-400		100-400	
	Charge	Treated	Charge	Treated	Charge	Treated	Charge	Treated	Charge	Treated	Charge	Treated	Charge	Treated	Charge	Treated
Mercaptan sulfur	0.012	None	0.074	0.0005	0.064	0.001	0.27	0.0007	0.18	0.0005	0.01	0.0001	0.058	0.0008	0.02	0.0006
Total sulfur	...	...	0.11	0.04	0.097	0.078	0.52	0.28	...	...	...	...	...	...	...	...
Octane No.:																
Clear	...	...	79	79	68.5	69.5	‡71.5	‡72.5	73.2	74.5			69.8	70.6		
+1.5 cc. TEL/gal.	...	...	...	...	...	...	...	...	75.9	77.9			75.2	77.0		
+3 cc. TEL/gal.	76.2	78	81	83.5	78.0	79.5	82.5	‡85.0	76.9	79.9			77.5	79.5		
Copper dish gum, mg./100 cc.:																
Clear	...	...	...	...	65	141	24	6	...	...	...	...	11	159	...	...
+10 lb. U.O.P.* No. 5/1,000 bbl.	...	...	...	...	...	1.5	...	8	...	...	...	...	...	¶3	...	...
+30 lb. U.O.P.* No. 5/1,000 bbl.	...	...	...	...	...	5.5	...	6	...	...	...	...	...	...	...	...
Induction period, (Army bomb), min.:																
Clear	...	...	...	...	40	10	...	Leak	...	...	...	...	65	30	...	...
+10 lb. U.O.P.* No. 5/1,000 bbl.	...	...	...	...	...	1,020	...	600	...	...	...	...	...	¶330	...	...
+30 lb. U.O.P.* No. 5/1,000 bbl.	...	...	...	...	...	1,500 (Cut)	...	1,500 (Cut)	...	...	...	...	...	...	...	...
A.S.T.M. gum, mg./100 cc.	...	...	...	...	1	2	1	1	...	...	...	...	...	...	...	...

Refers to U.O.P. inhibitor number. †Data incomplete as unit just started. ‡Octane numbers of a blend consisting of 30 per cent gasoline + 70 per cent reference fuel having octane number of 71.2 clear and 87.8 with 3 cc. TEL/gal. §Plant doctor treated. ¶18 lb. U.O.P. No. 4 per 1,000 bbl. (8.6 lb. active ingredient).

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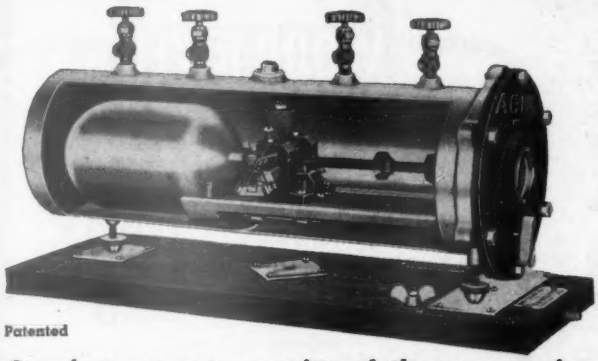

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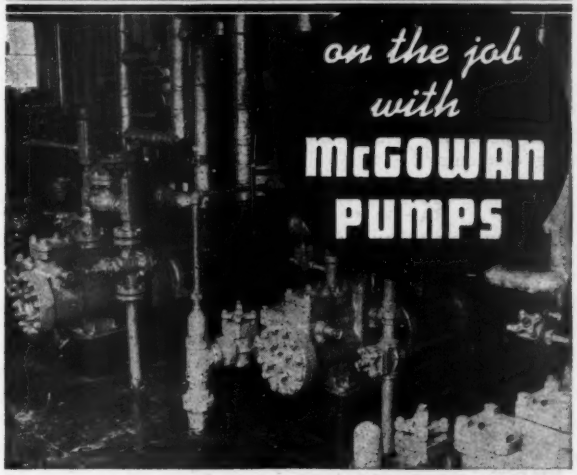

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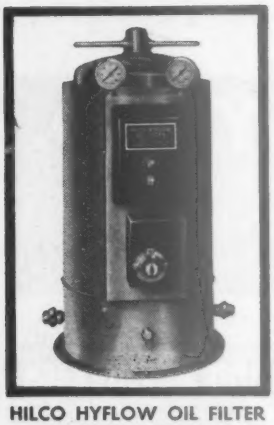

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the most varied types. Montana, California, Mid-Continent, and Gulf Coast gasolines have been treated. The oils have ranged from low to high end point. Some have been low in phenols, others high. Mercaptan contents have varied over an extreme range. Even gasoline coming from California's high-sulfur Santa Maria crude has been treated successfully.

Several papers have already been published describing the fundamental characteristics of the process and the operation of some of the plants.[1,2,3,4]

The flow of gasoline and treating reagents through a Unisol plant is outlined in Fig. 1. The process consists essentially of five steps:

1. Preliminary caustic washing to remove hydrogen sulfide, aliphatic acids, and if desired, phenols.—The contact with caustic should be thorough, as sulfides and salts of aliphatic acids are detrimental to the operation of the subsequent extraction step.

2. Extraction of mercaptans and removal of methanol from gasoline. Mercaptans are removed from the gasoline by countercurrent extraction in a packed column with a concentrated aqueous solution of caustic soda (approximately 48° Bé.) containing methanol. The caustic soda solution is introduced at the top of the column and flows downward countercurrent to gasoline rising from the bottom.

Methanol in amounts usually equal to about 30 to 40 per cent by volume of the caustic solution is introduced at about the midpoint of the column. This practice effectively divides the extraction column into two sections: In the lower section the extraction of mercaptans takes place, while in the upper portion of the column, the fresh caustic serves to extract residual methanol from the gasoline. The gasoline leaving the top of the column is clear and free of caustic. There is no tendency on the part of the reagent to absorb or entrain gasoline. A small vessel is provided in the exit line to separate any caustic which may be carried over should an accidental increase in gasoline rate cause the extractor to flood.

3. Regeneration of caustic.—Caustic methanol solution containing mercaptans, from the bottom of the extractor exchanges heat with regenerated caustic returning to the extractor and then enters the regeneration column, where methanol, mercaptans, and some water are removed by stripping with open steam. The heat required for this purpose is supplied by superheating the stripping steam or with a conventional reboiler. The caustic then returns to the extraction column.

4. Mercaptan separation. — The methanol, mercaptan, and water vapors from the regeneration column are condensed to produce a two-phase system: a lower aqueous methanol phase and an upper mercaptan oil phase. The two phases are then separated by skimming off the mercaptan oil.

5. Methanol recovery.—The aqueous methanol phase from Step 4 is fractionated to recover all of the methanol which is then circulated back to the extraction column.

Since two operations, mercaptan extraction and extraction of methanol dissolved in the gasoline, are accomplished in the same tower, the extraction column is of necessity fairly tall, usually containing some 60 ft. of Raschig rings.

As the reagent has an extremely high holding capacity for mercaptans the circulation rate may be very low. Usually only enough reagent circulation is required to wet satisfactorily the extractor packing and to provide effective countercurrent operation. This makes possible comparatively small regeneration equipment and keeps steam consumption at a minimum.

In general, low temperature favors extraction of mercaptans by caustic solutions. However, as temperatures much below 80° F. may cause solidification of the concentrated caustic reagent, the most satisfactory extractor temperatures are between 80° and 100° F. Temperatures up to 100° F. cause no substantial decrease in effectiveness of extraction.

The methanol returning to the extractor need not be anhydrous, but any water returned with the methanol must be evaporated in the caustic regeneration step requiring an expenditure of heat.

The operation of existing plants has proved that gasoline losses are extremely low, amounting substantially to the volume of mercaptan originally present.

If the parts of the plant in high-temperature caustic service are made of proper alloys, and are stress relieved, corrosion is avoided and expense for plant maintenance is minimized. Thus, the lower portion of the regenerator should be monel lined and lines carrying hot caustic at high temperature also should be made of nickel containing alloy.

The control of the plant is simple. The main control points are: the gravity of the caustic, the gravity of the methanol solution, and the bottom temperature of the methanol column.

Although a Unisol plant should be kept under regular supervision, only a very large plant requires the full time of an operator.

Table 1 shows commercial results obtained from a wide variety of gasolines. Results are included from all six units which are in operation.

These data show the adaptability of the process to treatment of gasolines of widely varying mercaptan content and indicate the very appreciable octane number improvement which may be realized.

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A.I.M.E. ABSTRACTS

Of technical papers presented at the annual fall meeting of Southern California Section, Ambassador Hotel, Los Angeles, October 19

Over-All Picture of Work Accomplished at Elk Hills

LT. JOHN DOMERCQ, U.S.N.R., Naval Petroleum Reserve No. 1, Elk Hills, Calif.

THIS paper outlines what has been done in the development of Naval Petroleum Reserve No. 1 since the start of operations in 1944. The primary function of this development work was to increase field production from 15,000 bbl. daily to 65,000 bbl. per day. Work was started June 29, 1944, and completed about 8 months later and involved the drilling of 317 wells including 4 holes which were abandoned as unproductive.

A total of 929,193 ft. of hole was drilled by 23 different drilling contractors and at the peak of operations there were 20 strings of tools in operation. The average drilling time was 14 days and the field was developed on the basis of 1 well to 10 acres on the surface and 1 well to 20 acres in the subsurface pattern. This was possible because two separate zones were being produced. All types of pumping equipment were employed and tank settings were on each quarter section. During Navy's operation, a total of 19,527,299 bbl. were produced of which Navy's share amounted to 12,463,811 bbl.

With the start of injection operations, a total of 15,000,000 cu. ft. of gas was injected daily and the natural gasoline plant recovered approximately 8,000 gal. of natural gasoline daily. Development work has revealed the existence of 4 major faults and a total of 10 altogether.

The primary development program started in June 1944, was concluded August 23, 1945, at which time field production was reduced to 15,000 bbl. per day.

At the present time the Navy Department is operating nine strings of drilling tools in an exploratory program involving shallow and deep production in the Hillcrest or west end of the Elk Hills structure.

Running Instruments in Annulus Of Tubed Wells

C. C. OLSON, Unit Operation, Naval Petroleum Reserve No. 1, Elk Hills, Calif.

THIS paper presented the advantages and savings incurred by making wire line measurements, depth pressure static tests, pumping draw down surveys or thermometric surveys in the annulus between casing and tubing. Instruments have been run in the annulus at a line speed of as high as 500 ft. per minute, although the rate of withdrawal should not exceed 250 ft. Wide variations in safe line speeds were not uncommon.

Annulus surveys resulted in a lower cost as it was no longer necessary to pull and run rods. To further reduce expense and also be able to remove the instrument without the pulling unit, a light weight hydraulic lifting device to raise the tubing a few inches was designed and constructed. The lifting operation was simple, fast, and easily accomplished by two men.

Te annulus method of running instruments is feasible for all pumping wells up to 4,000 ft. in depth. At present, conclusive data on wells deeper than 4,000 ft. are not available.

Annulus Method of Locating Water in An Oil Well

LT. JOHN HAGESTAD, U.S.N.R., Naval Petroleum Reserve No. 1, Elk Hills, Calif.

THE generally accepted method of locating water in most oil wells takes place under nearly static pressure conditions. Although this method is successful, several disadvantages must be overcome before an accurate water entry can be determined. In order to overcome disadvantages, a new procedure for water witching has been developed whereby the operating pressure in a well bore remains the same under test and producing conditions. The water entry can be located while the well continues to pump its daily production of oil and water.

This method gives a quick concise, subsurface picture of the water entry while the well is producing at normal operating pressure. The method is very flexible and full control of the electrolyte is maintained at all times. In wells with 6⅝-in. or 7-in. casing with 2½-in. tubing, it is suggested that several joints of 2-in. tubing be used on top to expedite removal of the instrument. The running time with annulus method is approximately 3.4 hours. After being run in the hole, the water entry is located within 35 minutes after the instrument has been placed on bottom.

Helium As a Tracer in Injected Gas

G. P. SHEA, U.S. Bureau of Mines.

IN January 1945, there was evidence of migration of injected gas at Elk Hills and a survey was immediately started. Various tracers were considered but it was finally decided to employ helium of 98.2 per cent purity as the ability to detect helium makes it the best tracer. The analysis is exacting but accurate and requires a relatively small amount of helium.

Helium injection started on June 7, 1945, in well 85-33-S. Unfortunately, production activities were discontinued August 23, 1945, before completion of the test. Some results were observed but the test was incomplete. The Bureau of Mines is soliciting cooperation with this type of work and would like to have some field or zone suggested where further investigating can be done.

At Elk Hills, tests indicated that injected gas was migrating across one fault altough only at one point. This occurred 40 days after helium had been introduced with the injected gas.

Because the operation was discontinued at the end of the war, it was never determined whether it was better to inject a large amount of helium for a short period of time, or a small amount of helium for a longer period.

Factors Influencing the Plugging Characteristics of an Oil Well Injection Water

WILLIAM F. CERINI, Union Oil Co., Compton, Calif.; WILLIS R. BATTLES, Union Oil Co., Wilmington, Calif.; P. H. JONES, Union Oil Co., Wilmington, Calif.

THE authors state a satisfactory test for determining the plugging characteristics of an oil well injection water has been developed and recommend installations of a filter on input wells. Briefly, this test consists of measuring the rate of change of the filter rate of a water with cumulative throughput when passing the water through a medium grade sintered glass disk. Application of the test method was made to water used in the Union Oil Co. experimental water flood of the Chapman zone in the Richfield field, Orange County, California. This water was found to develop increasing plugging tendencies upon aging, even though the finished water from the plant filter to storage exhibited little if any plugging characteristics. The plugging material was investigated and was found to consist of calcium carbonate, ferric hydroxide, and organic substances which were presumably largely of bacterial origin. Various methods of stabilizing this water to prevent the formation of plugging material were attempted. It was found that lowering the pH value to approximately 6.4 by injecting carbon dioxide, provided a moderately satisfactory means for chemical stabilization. However, a better method of stabilizing this water was found to consist of first aging and then filtering the water.

The Viscosity of Air, Water, Natural Gas, Crude Oil and Gas-Saturated Crude Oil at Oil Field Temperatures and Pressures

CARLTON BEAL, Consulting Petroleum Engineer, Los Angeles, Calif.

THIS PAPER presents useful charts for conversion of various viscosimeter units into centipoise and graphically summarizes published investigations of the viscosity of air, water and natural gas at high temperatures and pressures. Air, water and natural gas are considered because they are produced with, or used to produce crude oil. All terms in the report are converted to units used commonly in oil field work. Where posible, charts and correlations were constructed to cover a range of temperature and pressure encountered in oil fields. Correlation charts for the purpose of predicting crude oil viscosity and solubility behavior at oil field temperatures and pressures were constructed from an analysis and correlation of 1,332 viscosity and solubility observations from 953 crude oil samples taken from 747 oil fields. Of these fields, 501 were in the United States, including 75 in California. Of the 1,332 observations, 1,215 were viscosity values, including 786 of gas-free crude oil, 351 of oil saturated with gas and 78 under-saturated with gas at pressures above the bubble point.

Junior A.I.M.E. Has Round-Table Discussion

AT a recent meeting of the Southern California section of the Junior A.I.M.E. division, held at the Rio Hondo Country Club, Los Angeles, a round-table discussion, under a panel of experts composed of E. C. Babson, Ned Clark, Norris Johnston, E. K. Parks, and D. H. Sheldon, covered the following interesting discussion:

Q. What is the significance of gas saturation in ordinary core analysis?

A. With high gas saturation sand may produce gas or condensate. With high total saturation and little or no gas the sand may be a poor producer for lack of pressure.

Q. What are the methods for determining interstitial water?

A. In the field interstitial water can be determined by coring with oil-base mud or by coring with water-base mud, using a tracer. In the laboratory, it is measured by determining the residual water after capillary equilibrium is reached by means of a centrifuge.

The correlation of interstitial water with permeability is as satisfactory as other core analysis relationships.

Under some conditions in the Mid-Continent it is possible to calibrate the electric log in a well where the sand contains all water and then ascertain the interstitial water in the oil pool by comparing the two curves.

Q. What is the reason for poor accuracy in the gravity determination by core analysis?

A. The distillation method probably leaves a residue in the core. If high temperatures are used, the residue may be cracked into higher-gravity fractions.

Q. What causes drill pipe to stick where there is no salt-water intrusion, no heaving shale, and when the mud water loss is low?

A. Sticking may be the result of key seating if the hole is crooked. Use of long reamers and long drill collars will effectively eliminate the keyseat.

Mud may have a low water loss and yet a thick tough cake which will stick the drill pipe. If the mud lacks gel strength, the cuttings will fall back and may stick the pipe when circulation stops. When the rising velocity of the mud is low,

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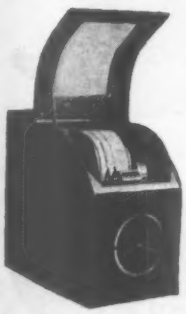

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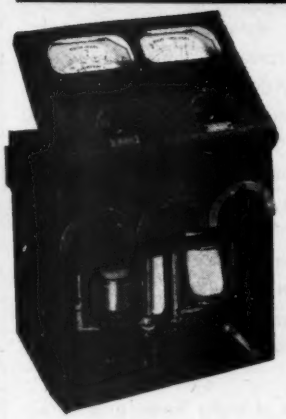

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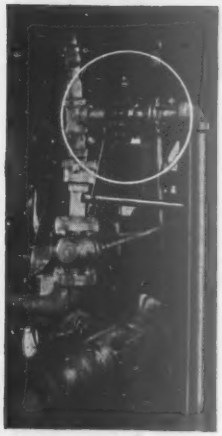

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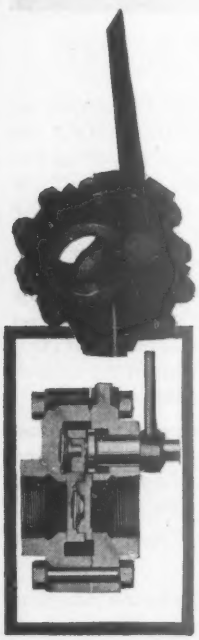

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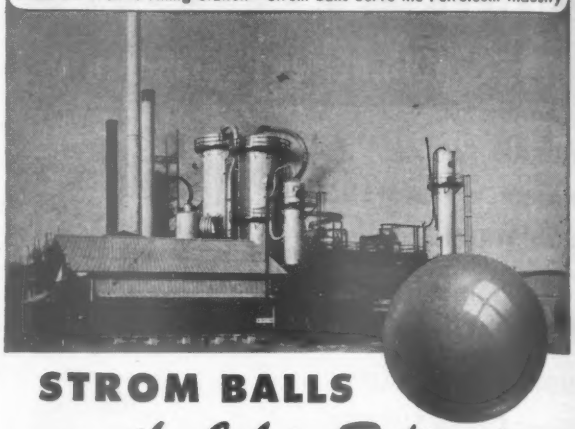

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the cutting may accumulate above the drill collars and cause stuck pipe.

Q. What is the importance of gravity drainage in California oil fields?

A. Rate of recovery by gravity drainage is a function of the steepness of the sand and the mobility of the oil. In the average California reservoir, recovery of oil by gravity drainage is slow and costly. Pressure maintenance is desirable in order to keep the mobility of the oil as high as possible and to drive more oil to the producing wells.

Q. What sweep efficiency can be anticipated in pressure maintenance by gas injection?

A. Sweeping effect is an additional benefit of gas injection since the primary purpose is to recover more oil in place.

Q. How can bypassing be stopped?

A. By redrilling wells to reduce the gas-oil ratio. Pressure maintenance has been practiced in three successive steps, each of which yields diminishing returns. First, came the stopping of gas waste; second, the reduction of gas pool gas-oil ratios by selective withdrawal from the low-ratio wells; and third, the control of reservoirs with low gas-oil ratio. If bypassing is considerable with gas injection, more oil may be recovered by pressure depletion followed by some secondary-recovery project.

Selective Completions

Selective completions initially may be more economic than pressure maintenance. Moral: Don't expose all of the interval.

Q. What conditions influence the choice between water or gas for pressure maintenance?

A. The supply of gas or water is important. The size and shape of the reservoir may be a deciding factor in the choice between gas or water. If the permeability of the sand is variable, gas injection would be chosen. Where the permeability is uniform, water may be preferable. Water may be more difficult to control and will also kill wells. Whereas, gas may bypass, but is less of a risk because wells continue to flow. Since water flooding is not well known in California, the wise procedure would be to inject all of the gas produced by the field and, if desired, start a pilot project for water drive. It is important to remember that if pressure is maintained, the viscosity of the oil remains low; but if the pressure is depleted and then restored, the viscosity will increase and stay high after repressuring.

Q. How can saturations be determined in the pool.

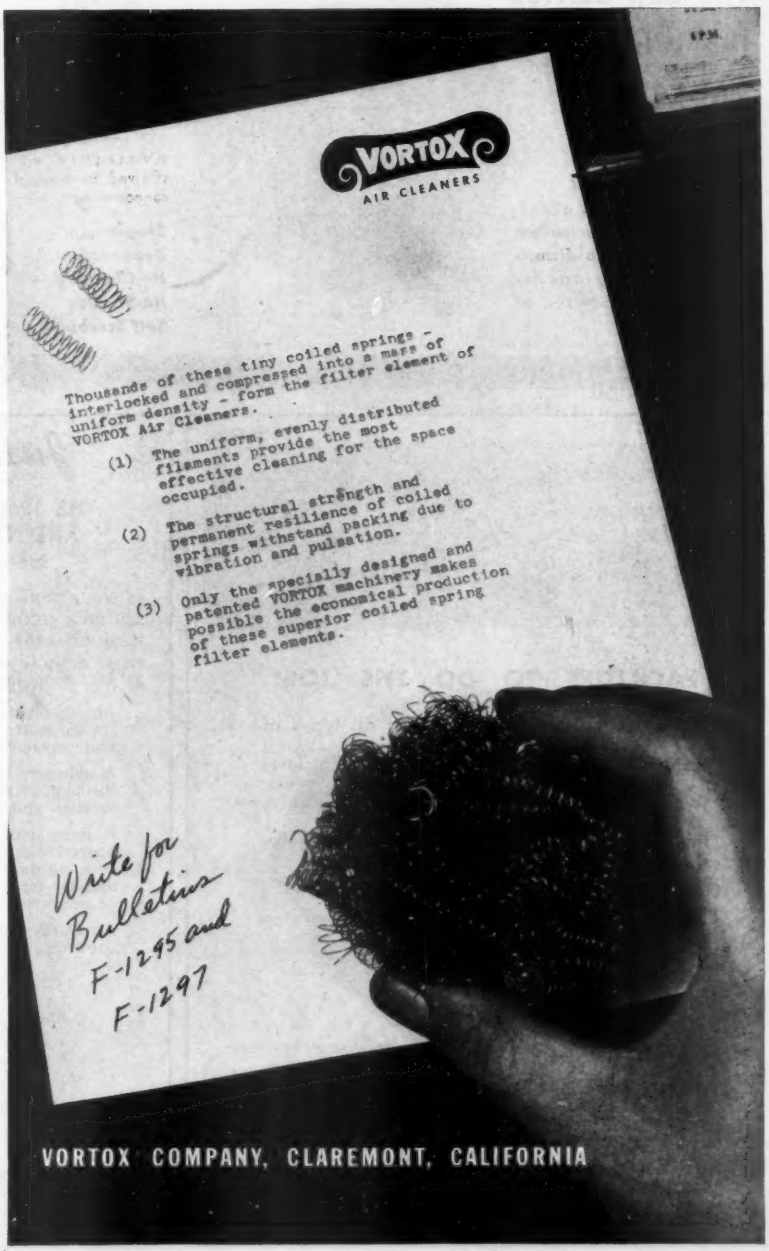
A. Saturations can be determined by P.V.T. tests on subsurface samples or recombined surface samples.

Q. What is the best drilling fluid for well completions?

A. Drilling in with crude oil has given the best results, especially if interval has little or no shale. Crude oil may form a plaster when mixed with shale.

Gage Lund has been elected chairman of the boards of The California Co. and Standard Oil Co. of Texas, both Standard Oil Co. of California subsidiaries. **K. H. Crandall** was named president of The California Co., succeeding Lund, and **J. W. Hoover** was elected a vice president. Lund's headquarters will be in San Francisco. Operating headquarters of Standard of Texas are in Houston and of The California Co., in New Orleans.

Lt. Col. Russell S. Hunt, recently relieved from active duty as legislative officer in the War Department, has returned to his former post as president of Aero Exploration Co., Tulsa. Two years of his military service was spent in the Mediterranean and European theaters. During his absence his position as head of Aero Exploration was filled by **T. N. Law,** who is also president of Falcon-Seaboard Drilling Co.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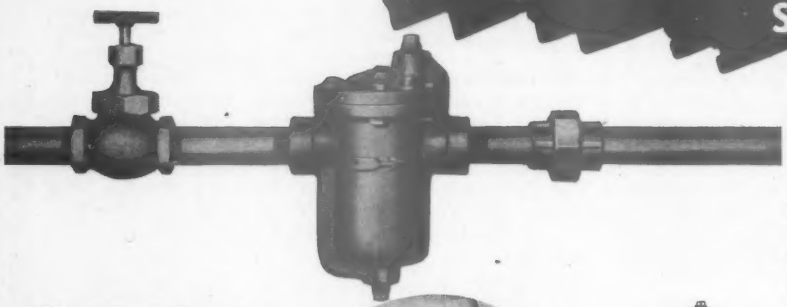

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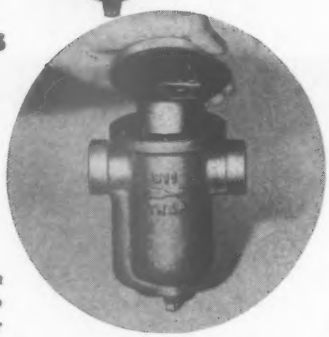

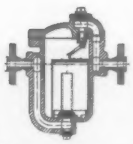

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THE OIL AND GAS JOURNAL
Tulsa 1, Oklahoma

QUESTIONS on TECHNOLOGY

by W. L. Nelson
Consulting Engineer

Short-Cut Estimate of Crude Oil Pipe Lines

I find many complicated formulas and charts for the design of crude-oil pipe lines but there is no simple way to quickly estimate pipe-line sizes or capacities. Can you direct me to a tabulation or chart for this purpose?—I.A.A.

The need of simple charts or tabulations for the design of small or short pipe lines is obvious. Such operations are confined to the use of standard sizes of pipe and the top pressure that such pipe can stand. Thus, there is no need of elaborate computations unless the operator is a large one who is ready to wait many years for a payout. No such charts or tabulations appear to be available and hence two tabulations have been computed as well as the fundamental friction loss data from which they were prepared.

TABLE 1—PRESSURE DROP PER MILE FOR SMALL NEW CRUDE PIPE LINES AS A FUNCTION OF CAPACITY

Capacity B.P.H.	Capacity B.P.D.	Viscosity Say. Univ. at 100° F.	Gravity A.P.I.	2″ psi./mi.	3″ psi./mi.	4″ psi./mi.	6″ psi./mi.
30	720	35	36-44	29	5.3	...	...
		50	27-38	37	7.0	...	...
		75	26-35	42	8.5	...	...
		100	24-33	45.5	...	...	...
40	960	35	36-44	45	8.3	...	...
		50	27-38	57	10.9	...	...
		75	26-35	65	12.3	...	...
		100	24-33	71	14.5	...	...
50	1,200	35	36-44	63	11.6	3.7	...
		50	27-38	80	15.3	4.9	...
		75	26-35	..	17.4	5.7	...
		100	24-33	..	18.8	7.0	...
75	1,800	35	36-44	..	21.5	6.9	...
		50	27-38	..	28.5	9.1	...
		75	26-35	..	32.5	10.1	...
		100	24-33	..	35	11.2	...
100	2,400	35	36-44	..	33.4	10.6	1.9
		50	27-38	..	44	14	2.5
		75	26-35	..	50	15.6	2.8
		100	24-33	..	64	17.1	3.1
125	3,000	35	36-44	..	47	15	2.6
		50	27-38	..	62	19.7	3.5
		75	26-35	..	70	24	3.9
		100	24-33	..	76	28	4.3
150	3,600	35	36-44	..	63	19.6	3.4
		50	27-38	..	82	25.7	4.6
		75	26-35	..	92	28.8	5.2
		100	24-33	..	100	31.8	5.7
200	4,800	35	36-44	..	..	30.3	5.4
		50	27-38	..	..	39.7	7.2
		75	26-35	..	..	44.5	8.0
		100	24-33	..	..	49.0	8.7
250	6,000	35	36-44	..	..	43	7.5
		50	27-38	..	..	56	10.0
		75	26-35	..	..	62	11.2
		100	24-33	..	..	68	12.2
300	7,200	35	36-44	..	..	56	9.9
		50	27-38	..	..	73	13.2
		75	26-35	..	..	82	14.7
		100	24-33	..	..	91	16.1
400	9,600	35	36-44	..	..	..	15.3
		50	27-38	..	..	..	20.3
		75	26-35	..	..	..	22.5
		100	24-33	..	..	..	24.7
500	12,000	35	36-44	..	..	..	21.4
		50	27-38	..	..	..	28.5
		75	26-35	..	..	..	31.7
		100	24-33	..	..	..	34.7

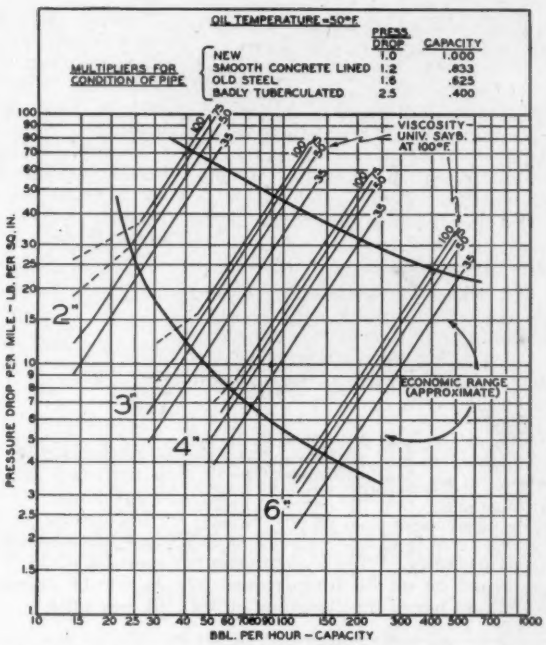

Fig. 1—Chart for approximating pressure drops or capacities of crude-oil pipe lines of standard pipe

TABLE 2—CAPACITIES OF SMALL NEW CRUDE PIPE LINES AS A FUNCTION OF PRESSURE DROP PER MILE

Pressure drop per mi., psi.	Viscosity Say. Univ. at 100° F.	Gravity A.P.I.	2″ B.P.H.	3″ B.P.H.	4″ B.P.H.	6″ B.P.H.
5	35	36-44	..	...	60	191
	50	27-38	..	...	51	158
	75	26-35	..	...	...	147
	100	24-33	..	...	...	139
10	35	36-44	..	45	98	302
	50	27-38	..	38	80	250
	75	26-35	..	35	74	232
	100	24-33	..	..	70	218
15	35	36-44	19.5	59	125	395
	50	27-38	16.5	49	104	327
	75	26-35	..	45	97	303
	100	24-33	..	42	91	287
20	35	36-44	23.5	71	152	478
	50	27-38	20	60	126	397
	75	26-35	..	55	117	368
	100	24-33	..	52	110	347
30	35	36-44	31	93	197	...
	50	27-38	26	78	166	...
	75	26-35	24	72	153	482
	100	24-33	18	68	145	454
40	35	36-44	37	112	240	...
	50	27-38	32	94	202	...
	75	26-35	29	86	186	...
	100	24-33	27.5	82	175	...
50	35	36-44	43	130	...	...
	50	27-38	37	108	...	...
	75	26-35	33.5	100	...	...
	100	24-33	32	95	...	...

Economic Limits. — Approximate economic limits are outlined on Tables 1 and 2 and Fig. 1. Unless the situation has peculiar economic advantages, the selection of line size or capacity should not fall outside the economic limits shown. The economy of lines larger than 6-in. should be studied by an engineer.

Viscosity.—Although many crude oils are heavier or lighter than the 35-100 Universal Saybolt viscosity (at 100° F.) range shown, more viscous ones are not shown because the pressure drop caused by them changes so rapidly that the design should be put in the hands of an engineer. With respect to crude oils thinner than 35 viscosity, it was thought that no one should plan on such thin oils because occasions will certainly arise when a viscosity of 35 or more will be encountered.

Old lines.—The values on both the figure and the tables are the very maximum that can be expected. They are for new clean pipe and hence the following factors should be applied as necessary:

	Multiplier for pressure drop	Multiplier for capacity
Concrete lined (smooth)	1.2	0.833
Old steel pipe	1.6	0.625
Badly tuberculated pipe	2.5	0.400

Temperature. — The computations are based on an oil temperature of 50° F. and hence the figure or tables cannot be used for unburied lines. Common pipe-line temperatures are:

	(°F.)
Illinois and Northwest Missouri	33-72
Oklahoma and Kansas	30-82
Eastern Texas	45-84

Thus, capacities during the winter will be only 88 to 95 per cent of the values shown and the greatest drop in capacity is for the more viscous oils.

Gravity is not a major variable and it varies so widely with the base of oil (asphalt or paraffinic) that it is of little value in using the charts and in fact its use may be misleading.

Example 1.—A 40-mile line is to handle 900 bbl. per day of a 40-viscosity crude oil. A pump which will produce 700 lb. is available. The pressure drop per mile is:

$$\frac{700}{40} = 17.5$$

and the hourly capacity is:

$$\frac{900}{24} = 37.5 \text{ bbl. per hour}$$

According to Table 1 a 2-in. line is too small and a 3-in. line is somewhat large.

According to Table 2 a 2-in. line could handle only about 21 bbl. per hour whereas a 3-in. line (see Fig. 1) would operate at only about 8 lb. per mile.

A 3-in. line would be used and it could operate at 300-400 psi. At 700 lb. it could handle about 62 bbl. per hour or 1,500 bbl. per day.

Example 2.—An 80-mile 6-in. line is available for the handling of a 90-viscosity crude oil and it is good for a pressure of 500 lb. The maximum pressure drop per mile is:

$$\frac{500}{80} = 6.25 \text{ psi.}$$

By interpolating on Table 2 it could handle about 164 bbl. per hour or by Table 1, about 167 bbl. per hour, whereas more accurately from Fig. 1, about 165 bbl. per hour.

C. H. Keen, assistant division production superintendent of the Louisiana division, at New Orleans, for Humble Oil & Refining Co., and **S. S. Langford,** holding a corresponding post at Corpus Christi, in the Southwest Texas division, have exchanged positions. **L. H. Riley,** district production superintendent in the Wink district, West Texas division, has been transferred to the Natchez district, Louisiana division. His place at Wink was filled by transferring **M. M. Rogers,** who had been district production superintendent in the Wasson district, West Texas division. Rogers was replaced by promotion of **Homer McCarty,** formerly assistant production superintendent in the Wasson district.

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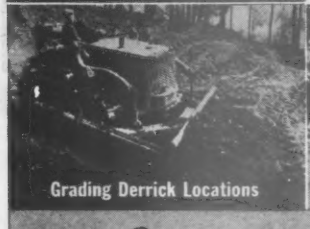

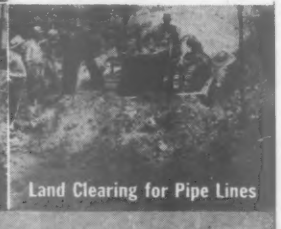

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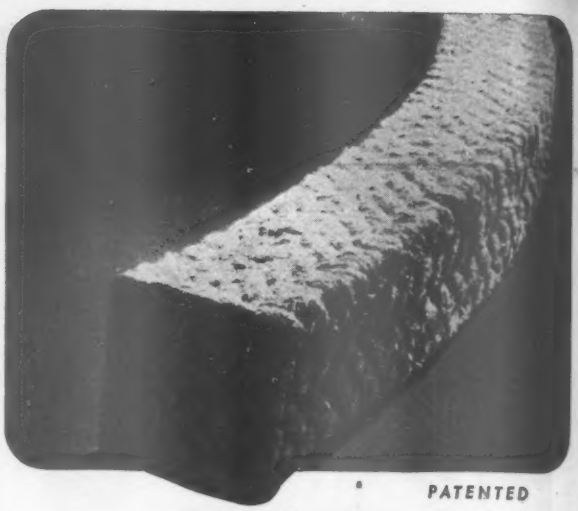

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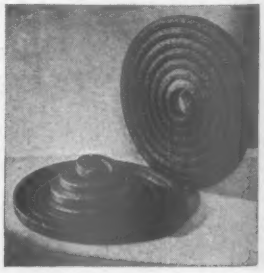

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(Continued from page 93)

approximately 1,200 psi. to maintain the necessary back pressure in the gathering system.

Flowing pressures for the upper and lower Pettit horizons, in which, currently, most of the wells are being completed, range from 2,500 to 2,800 psi. Present operating practice usually calls for dropping this pressure to 1,800 psi. in the first-stage reduction. This is held by a setting of approximately 40-in. differential pressure at the controller recorder.

Uniform gas temperature is held by a thermostat located in the flow line from the second-stage pressure-reducing control to the separator. This has a control to the fuel supply for the heater burners, automatically increasing or decreasing the fuel as the temperature of the gas tends to lower or rise. Normally the thermostat is set to maintain a gas temperature of from 67° to 70° F.

Each heater also is equipped with a thermostat for maximum water temperature. This functions independently of the gas temperature control to reduce the burner fuel supply when the temperature of the water reaches a set maximum. This serves to prevent excess heating of the gas through the heater coils should the gas temperature control, in event of possible abnormally low temperature on the down side of the second-stage reduction, allow the burners to heat too heavily. Usually, it is desired to hold the water temperature to a maximum of 135° F.

Dual-Coil Heaters

Dual-coil heaters, permitting two-stage gas heating in a single unit, are being used. Each is 9 ft. long, 4 ft. 7 in. high and 2 ft. 2 in. wide. Coils are designed for 5,000 psi. working pressure and are equipped with pressure-vacuum safety valves, providing the necessary safety factor for the pressures handled.

Separators are designed for 1,500-psi. working pressure. Each is provided with an overhead blowoff line to a relief regulator valve setting (C and C_1 in the accompanying flow diagram). As an additional safety precaution, the bypass in the relief regulator setting is equipped with a 2,400-psi. safety head. Relief is through a 2-in. line to a flare.

Bypasses in the first and second-stage control valve settings (B and B_1 and A and A_1) are equipped with a 6,000-psi. test adjustable choke to control the gas flow when changes or adjustments are being made in the control valves.

All gas flow through the control valve and relief regulator settings is in the same direction.

Heater-fuel and control-gas supply is taken directly off the separator blowoff line through a 1-in. line connection. A main regulator at the blowoff line connection reduces the pressure to from 80 to 100 psi. in the system. An additional regulator is placed at each heater to control the gas to the burners. Other regulators are placed to make further reduction to the control valves.

Separators are equipped dual-gravity automatic drainers for removal of any water accumulation. In these, the float-controlled valve on the drip accumulator functions on the gravity differential between water and distillate.

Distillate production is metered through a positive displacement-type meter placed at the separator on the fluid discharge outlet. Gas volume is measured through the differential pressure recorder at the orifice setting on the gas outlet line. When the company's proposed gasoline plant is placed in operation, and production is taken by its gathering system, both streams will be combined after metering. Pending that, distillate production is being run to field storage. Wells, for which there at present is no gasline connection or other use for the gas, are shut in.

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PRACTICAL PETROLEUM ENGINEERING

Fluid Flow

Graphic Solutions of Design Problems

3—Pressure Drop for Liquid Flow

by Paul Buthod and B. W. Whiteley

Last week's installment on fluid flow discussed the basic equation for computing fluid friction loss in a pipe. Two charts (Figs. 2-1 and 2-2) for determining the friction factor and a discussion on the relationship between the relative roughness of pipe surface, Reynolds number and the friction factor were included.

PRESSURE drop for liquids flowing through circular pipes is based on the Darcy formula:

$$h_f = \frac{flu^2}{2gd} \qquad (1)$$

This equation may be rewritten in terms of various units commonly used in engineering practice and becomes:

$$\Delta P_f = \rho flu^2/2gd \times 144 = 0.001294\,\rho flu^2/D = 43.5\,\rho flV^2/D^5 = 43.5\,flW^2/\rho D^5$$
$$= 0.000216\,\rho flQ_L^2/D^5 = 0.0001058\,\rho flB^2/D^5 = 0.0066\,sflB^2/D^5 \qquad (2)$$

The various symbols are explained in the accompanying notation. The above equations are applicable to any type of fluid if the density, viscosity and velocity are the same for all points along the length of the line. This, in effect, restricts the above equations to the isothermal flow of incompressible fluids.

They may be used in some instances, however, for the flow of compressible fluids such as gases, if the pressure drop is small and hence the inlet and outlet gas velocities are approximately the same.

Any large temperature changes along the length of the line will affect the viscosity of petroleum liquids to a marked degree. This results in a change in the Reynolds number. However, large changes in the Reynolds number affect the friction factor to a small degree and within reasonable limits the condition of isothermal flow may be neglected. For instances where large temperature changes occur between the inlet and outlet ends of the pipe, the line may be divided into zones such that the friction factor is substantially constant for a particular zone. A somewhat more accurate calculation can be made by means of graphical integration.

In order to facilitate calculations involving friction drop, the accompanying chart (Fig. 3-1), which is based on Equation 2 may be used.

The accompanying chart is illustrated by the following examples:

Example 1.—A 6-in. standard commercial steel pipe is to handle a 36° A.P.I. gas oil at an average temperature of 80° F. At this temperature the kinematic viscosity of the oil is 6.3 centistokes. The line is 25 miles long, the elevation of the inlet end being 763 ft. above sea level and the elevation of the outlet end being 832 ft. The line discharges at atmospheric pressure. Determine the necessary pressure at the inlet end to handle 10,000 bbl. per day.

Solution.—The rate of flow is:

$$10{,}000 \div 24 = 417 \text{ bbl. per hour}$$

Using this flow rate for a 6.065-in. i.d. pipe and a kinematic viscosity of 6.3 centistokes, the Reynolds number is found to be 24,000. (Article 1—this series.)

For a 6-in. commercial steel pipe the relative roughness (ϵ/d) is 0.0003 and using a value of Re = 24,000, the friction factor is 0.0253. (Article 2—this series.)

A 36° A.P.I. oil has a specific gravity of 0.854 at 80° F.

To determine the friction loss in the line, the accompanying chart (Fig. 3-1) is used. Start on the bottom scale at a flow rate of 417 bbl. per hour and rise vertically to a friction factor line of 0.0253, thence horizontally to a pipe diameter of 6.065-in. From this point proceed vertically to a specific gravity line of 0.854 and moving parallel to the diagonal guide lines, read a value of 3.2 psi. per 1,000 ft. of pipe for the friction loss. For 25 miles of line the total friction loss is:

$$3.2 \times (5{,}280/1{,}000) \times 25 = 422 \text{ psi.}$$

The additional pressure necessary to overcome the difference in elevation head is:

$$\frac{62.4}{144} \times (832 - 763) \times 0.854$$
$$= 25.5 \text{ psi.}$$

The necessary pump pressure at the inlet end is:

$$422 + 25.5 = 448 \text{ psig.}$$

Example 2.—If the line in Example 1 were replaced by 8-in. standard steel pipe, what quantity of oil could be handled by the same pump pressure at the inlet end?

Solution.—This problem involves a trial-and-error solution since the Reynolds number and hence the friction factor cannot be determined accurately unless the flow rate is known. However, this presents no serious drawback since the solution may be obtained in a few seconds by means of the charts. The procedure consists in assuming a value of "f," determining the flow rate by means of Fig. 3-1, computing the Reynolds number and checking the corresponding friction factor against the initial assumed value of "f."

In the present example assume "f" = 0.02. Using the accompanying chart, and starting at a pressure drop of 3.2 psi. per 1,000 ft., the graphical procedure is exactly the reverse from that followed in Example 1, and flow rate is found to be 930 bbl. per hour on the bottom scale.

Using a value of 930 bbl. per hour for the flow rate, the Reynolds number is found to be 41,000 (Article 1—this series) and the corresponding friction factor (Article 2—this series) is 0.0225.

This value of "f" does not check the initial assumed value, hence the procedure is repeated using "f" = 0.0225 as the initial assumed value.

This second calculation gives:

Flow rate = 875 bbl. per hour
Re = 39,000
"f" = 0.0227

Since the calculated value of "f" checks the assumed value closely,

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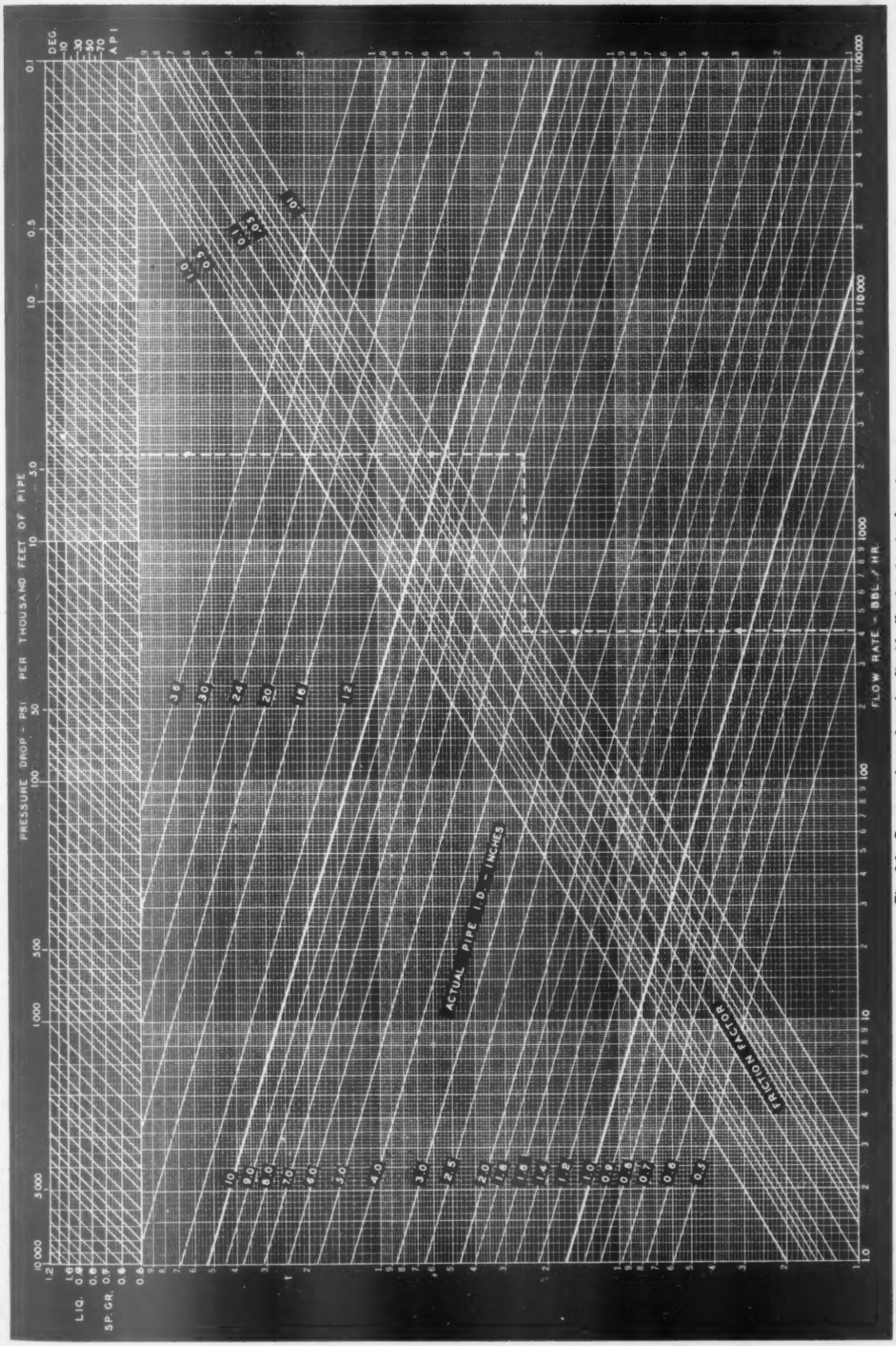

Fig. 3-1—Pressure-drop chart for liquids flowing in circular pipes

Famous Facts

"The Wedding of the Rails"—the driving of the golden and silver spikes to symbolize the joining of the Central Pacific and the Union Pacific lines—at Promontory Point, Utah, May 10, 1869, marked the completion of the first transcontinental railroad. Four years before, the Union Pacific had begun to lay its 1,085.8 miles of track westward from Omaha, Nebraska. At the same time, the Central Pacific was coming eastward with its 690 miles.

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the flow rate will be 875 bbl. per hour or:

$$875 \times 24 = 21{,}000 \text{ bbl. per day}$$

In instances such that the flow rate and pressure loss are given, and it is necessary to determine the pipe diameter, a somewhat similar procedure as that outlined in Example 2, is followed.

A value for the friction factor is assumed, and the necessary pipe diameter is found by means of Fig. 3-1. The Reynolds number and corresponding friction factor are then determined. If the calculated value of the friction factor does not check the previously assumed value, the procedure is repeated using the calculated friction factor for the assumed value in the second trial.

Notation:

- B = flow rate, bbl./hr.
- d = actual pipe i.d., ft.
- D = actual pipe i.d., in.
- f = friction factor, dimensionless
- g = acceleration due to gravity—32.2 ft./sec.^{2}
- h_f = loss in head due to friction, ft.
- l = length of line, ft.
- ΔP_f = pressure drop, psi.
- Q_L = flow rate, gal./min.
- Re = Reynolds number, dimensionless
- s = specific gravity
- u = linear velocity, ft./sec.
- V = flow rate, cu. ft./sec.
- W = flow rate, lb./sec.
- ρ = density, lb./cu. ft.

R. W. Tesch, Jr., of Fort Worth, recently relieved from duty as a captain in the Army, has joined Texas Pacific Coal & Oil Co. as chief production engineer. Before entering military service he was an engineer for Stanolind Oil & Gas Co. Tesch, a graduate of Colorado School of Mines, was called into service in 1942 and assisted in building gasoline facilities for ferry routes in Africa. He returned to the states in 1943 and was chief of maintenance at Camp Hulen until early in 1945 when assigned to District 2. Petroleum Administrator for War at Chicago, as chief of reserves. He held that position until relieved from active duty.

Harold A. Freeman, production engineer for Iraq Petroleum Co., Ltd., has arrived in the United States and is visiting oil fields, comparing production methods of this country with those of Iraq. He was a guest recently in Austin of **E. O. Thompson,** member of the Texas Railroad Commission, who met him while touring middle-eastern oil areas for the Government.

A FEATURE OF THE OIL AND GAS JOURNAL

Results of Acidizing

Results of acidizing prorated wells show up in higher productivity indices. For wells producing at capacity the actual oil rate usually is increased, as shown in this article. An increase in oil rate may be considered in two ways: (1) As more rapid recovery, at a lower cost per barrel, (2) as an increase in ultimate recovery. Either way, in broad sense, is "additional recovery."

BASICALLY, the acidization of calcareous pays exposed in wells creates additional flow channels which result in higher productivity. This means that for a given drop in bottom-hole pressure, the well will produce more barrels per day. The over-all effect, in essence, is the same as that which results from shooting of wells which are productive from sandstone formations. On this basis, alone, acidizing of wells generally is quite beneficial as in many cases it allows wells to produce at higher rates than they would be capable of if untreated.

Four examples of what may be termed "good" results of acid treatments are shown in Fig. 1, a, b, c and d. It will be noted that as a result of acid treatments the rate of subsequent production was markedly increased.

Some engineers and production men term as "additional recovery" the quantity of oil represented between the curves before and after acid treating. Whether this classification is strictly true often is a moot question. Sometimes economic arguments must be thrown into the picture in order to justify the claim for additional recovery. However, it is certainly true that every well has an economic limit of rate of production, below which operation is at a loss. If acidizing can speed up the rate of oil recovery to the point where more oil is recovered before the well reaches this economic limit, the claim for the extra oil as "economic additional recovery" definitely can be justified.

On the other hand, there are many instances where acidizing has actually been responsible for the completion of commercial oil wells which otherwise had only a bare "show," and would have been abandoned without production. Such instances have been found in practically every state where oil is produced from limestones or dolomites. In cases of this kind, a well may have shown no more than stains in the cuttings or cores when drilled in. The first one or two acid jobs may have improved conditions but little. However, additional acid treatments, sometimes combined with nitroglycerin shooting, have been responsible for finally obtaining good producers.

There is nothing magical or extraordinary about such acidizing results when it is remembered that most calcareous formations are quite erratic in their porosity arrangement, location of fissures, cracks and the like. Where such erratic conditions prevail, it is not fully unexpected for a 6-in. hole to penetrate through an oil productive formation without ever hitting a communicating porous

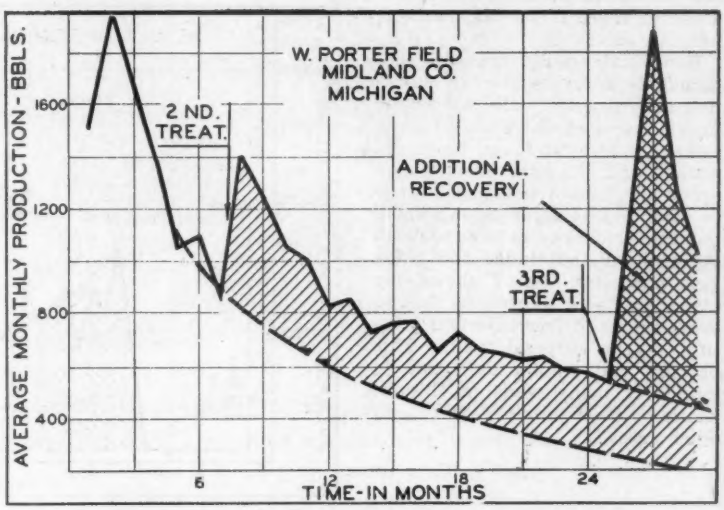

Fig. 1 (a)—Virtually all Dundee lime wells are acidized

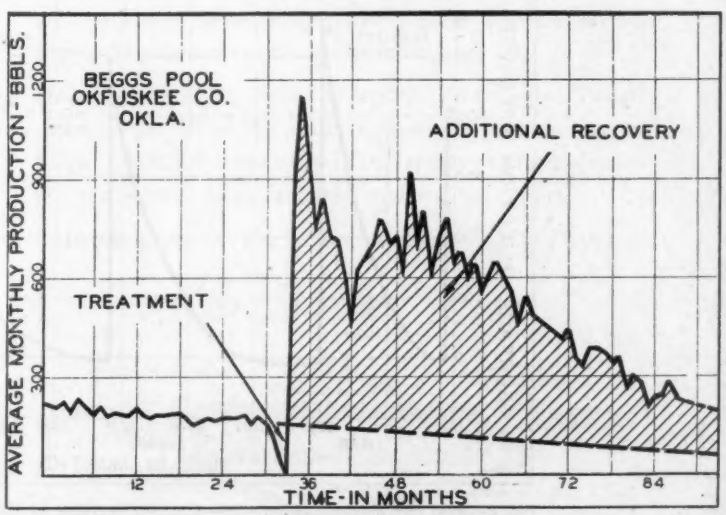

Fig. 1 (b)—Shaded area equals 15,000 bbl. oil

Engineering Fundamentals

(Continued)

system, fissure or crack, or at least only a few. In such cases the acid treatment simply dissolves sufficient limestone and dolomite to open the well up to where it is a communicating and producing entity with the reservoir. In these cases, one can well claim that 100 per cent of the well's oil recovery is due to the acid treatment. However, one must have geological promise to undertake such attempts, as it is obvious that a dry hole cannot be acidized into a producer if there is no oil reservoir near at hand.

Beneficial results are also obtained from acidization of injection and disposal wells where the formations are calcareous. In many cases it has been found more expedient and less expensive to open up or get salt-water-disposal wells to take more water by acidizing them than to move in tools to clean out accumulated sludge and plugging materials. Fig. 2 shows the effect that acid treatments had in lowering the surface injection pressure in one disposal well. This practice and similar data can be found for many wells in Illinois, Kansas, Oklahoma, Texas, and other areas.

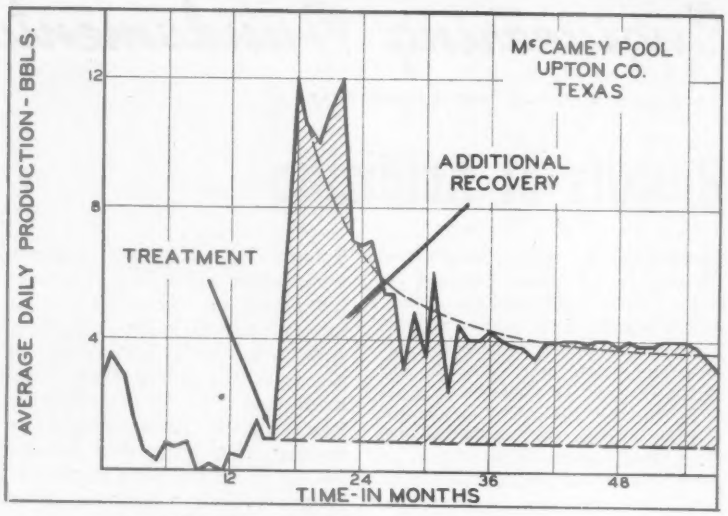

Fig. 1 (c)—This well was noncommercial before acidizing

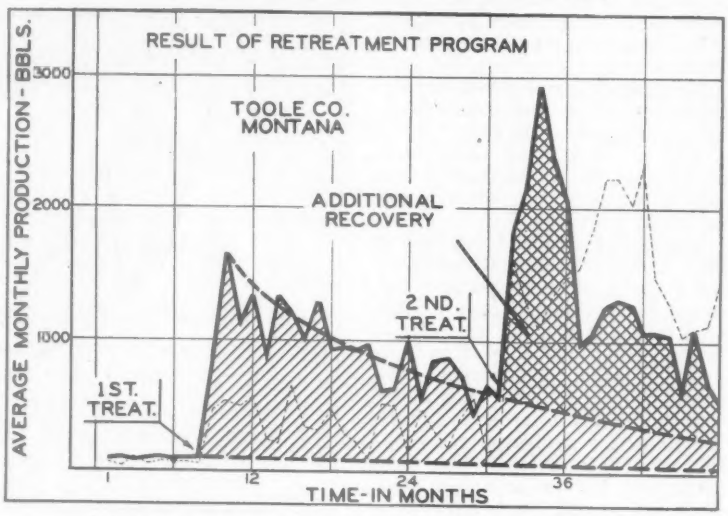

Fig. 1 (d)—Ten-fold increases in oil rate by each acid treatment

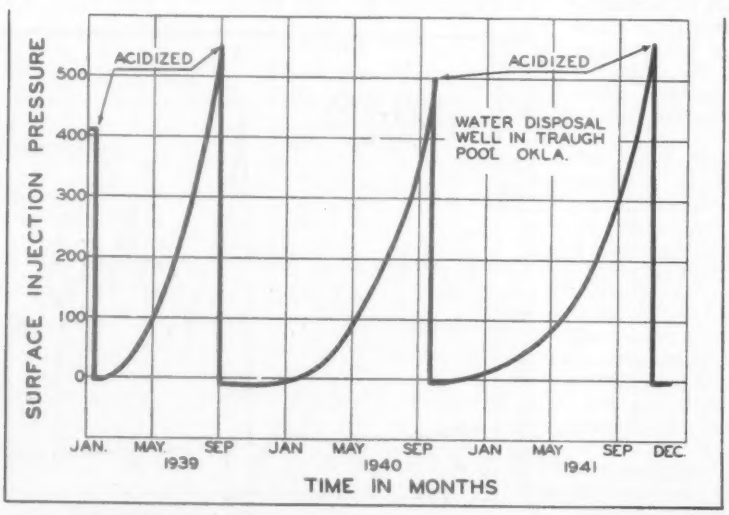

Fig. 2—Acid treatments lowered water-injection pressure of this disposal well. When scale deposits reaccumulated, another treatment was made

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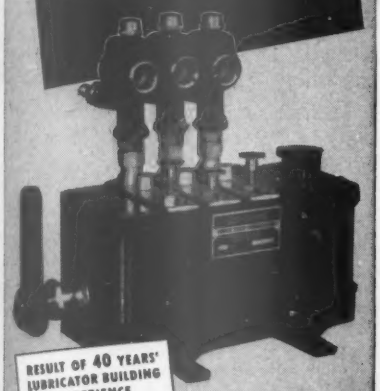

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The Refiner's Notebook

A WEEKLY FEATURE OF THE OIL AND GAS JOURNAL

Thickness of Welded Towers

TABLES 1, 2, and 3 show recommended thicknesses for welded towers operating under typical conditions of topping, cracking and gas recovery. The conditions contemplated are:

	Topping 700 and lower	Cracking 700-850	Gas 300 and lower
Temp., °F.—			
Corrosion, allowance, in.	0.2	0.25	0.15
Tensile strength, psi.	11,000	7,000	15,000
Pressure, psig.	5-100	20-140	50-300

The numbers in parenthesis are minimum (or retiring) thicknesses and of course when a vessel gets thin it can be lined as protection against further corrosion. No allowance is made for the reinforcing action of welded plates, internal steel, etc. All thicknesses were computed from:

$$t = \frac{PD}{2S} + \text{corr.}$$

in which t is thickness in inches, P is pressure psig., D is diameter in inches and S is metal stress, psi.

Welded heads. — Although the head thickness of hemispherical heads can be only half the thickness of the shell metal, the largest radius heads allowed by A.P.I. and A.S.M.E. call for thicknesses 50 per cent (elliptical) and 75 per cent (dished) greater than the shell thickness of the tower. Thus, the heads of the towers of Tables 1, 2, and 3 with the worst designs allowed by A.P.I.-A.S.M.E., and considering the corrosion allowance, should be thicker than the shell of the tower by $\frac{1}{8}$ to $\frac{5}{8}$ in. The lowest value is for small-diameter low-pressure towers whereas the $\frac{5}{8}$ in. of extra thickness is for the largest high-pressure towers shown.

Dished heads:

$$t = \frac{W}{2} \times \frac{PR_c}{S} + C$$

$$\text{max. } t = \frac{1.75}{2} \times \frac{PD}{S} + C$$

$$\text{min. } t = \frac{1}{4} \times \frac{PD}{S} + C$$

Ellipsoidal heads:

$$t = \frac{V}{2} \times \frac{PD}{S} + C$$

$$\text{max. } t = \frac{1.5}{2} \times \frac{PD}{S} + C$$

$$\text{min. } t = \frac{0.5}{2} \times \frac{PD}{S} + C$$

The symbols are the same except R_c refers to radius of curvature of head in inches and V and W are constants whose values are given in the A.S.M.E.-A.P.I. code.

TABLE 1—THICKNESS (NO CORROSION ALLOWANCE IN PARENTHESIS) OF TOPPING TOWERS AND VESSELS (700° F. AND LOWER), WITH 0.2-IN. CORROSION ALLOWANCE, AND FOR METAL STRESS OF 11,000 PSI.

In. diam. (Ft.-in.)	(In.)	5 psig.	30 psig.	50 psig.	70 psig.	100 psig.
3-0	36	(.008) .208	(.05) .25	(.08) .28	(.11) .31	(.14) .34
3-6	42	(.010) .210	(.06) .26	(.10) .30	(.13) .33	(.19) .39
4-0	48	(.011) .211	(.07) .27	(.11) .31	(.15) .35	(.22) .42
4-6	54	(.013) .213	(.07) .27	(.12) .32	(.17) .37	(.25) .45
5-0	60	(.014) .214	(.08) .28	(.14) .34	(.19) .39	(.27) .47
5-6	66	(.015) .215	(.09) .29	(.15) .35	(.21) .41	(.30) .50
6-0	72	(.017) .217	(.10) .30	(.17) .37	(.23) .43	(.33) *.53
6-6	78	(.018) .218	(.11) .31	(.18) .38	(.25) .45	(.36) *.56
7-0	84	(.019) .219	(.12) .32	(.19) .39	(.27) .47	(.39) *.59
8-0	96	(.022) .222	(.13) .33	(.22) .42	(.32) *.52	(.44) *.64
9-0	108	(.025) .225	(.15) .35	(.25) .45	(.35) *.55	(.49) *.69
10-0	120	(.028) .228	(.17) .37	(.28) .48	(.38) *.58	(.55) *.75

*Additional allowance for corrosion or use of thinner towers with linings is usually economical.

TABLE 2—THICKNESS (NO CORROSION ALLOWANCE IN PARENTHESIS) OF HIGH-TEMPERATURE OR CRACKING TOWERS AND VESSELS (700°-850° F.), WITH 0.25 CORROSION ALLOWANCE, AND FOR METAL STRESS OF 7,000 PSI.

In. diam. (Ft.-in.)	(In.)	20 psig.	40 psig.	60 psig.	80 psig.	100 psig.	120 psig	140 psig.
3-0	36	(.05) .30	(.11) .36	(.15) .40	(.21) .46	(.26) .51	(.31) .56	(.36) .61
4-0	48	(.07) .32	(.14) .39	(.21) .46	(.28) .53	(.34) .59	(.41) .66	(.48) .73
5-0	60	(.09) .34	(.17) .42	(.26) .51	(.35) .60	(.43) .68	(.51) .76	(.60) *.85
6-0	72	(.11) .36	(.21) .46	(.31) .56	(.41) .66	(.51) .76	(.62) *.87	(.72) *.97
7-0	84	(.12) .37	(.24) .49	(.36) .61	(.48) .73	(.60) *.85	(.72) *.97	(.84)*1.09
8-0	96	(.14) .39	(.28) .53	(.42) .67	(.55) .80	(.69) *.94	(.82)*1.07	....
9-0	108	(.16) .41	(.31) .56	(.47) .72	(.62) *.87	(.78)*1.03	....	....
10-0	120	(.17) .42	(.35) .60	(.52) .77	(.69) *.94	....	....	....
11-0	132	(.19) .44	(.38) .63	(.57) .82	(.76)*1.01	....	....	....

*Cheaper to use corrosion resistant liners and often so with smaller or old towers.

TABLE 3—THICKNESSES (NO CORROSION ALLOWANCE IN PARENTHESIS) OF GAS SYSTEM TOWERS AND VESSELS (UNDER 300° F.), WITH 0.15-IN. CORROSION ALLOWANCE, AND FOR METAL STRESS OF 15,000 PSI.

In. diam. (Ft.-in.)	(In.)	50 psig.	75 psig.	100 psig.	125 psig.	150 psig.	175 psig.	200 psig.	225 psig.	250 psig.	300 psig.
2-6	30	....	....	....	....	....	....	(.20) .35	(.23) .38	(.25) .40	(.30) .45
3-0	36	(.06) .21	(.09) .24	(.12) .27	(.15) .30	(.18) .33	(.21) .36	(.24) .39	(.27) .42	(.30) .45	(.36) .51
3-6	42	(.07) .22	(.11) .26	(.14) .29	(.18) .33	(.21) .36	(.25) .40	(.28) .43	(.32) .47	(.35) .50	(.42) .57
4-0	48	(.08) .23	(.12) .27	(.16) .31	(.20) .35	(.24) .39	(.28) .43	(.32) .47	(.36) .51	(.40) .55	(.48) .63
4-6	54	(.09) .24	(.14) .29	(.18) .33	(.23) .38	(.27) .42	(.32) .47	(.36) .51	(.41) .56	(.45) .60	(.54) .69
5-0	60	(.10) .25	(.15) .30	(.20) .35	(.25) .40	(.30) .45	(.35) .50	(.40) .55	(.45) .60	(.50) .65	(.60) .75
5-6	66	(.11) .26	(.17) .32	(.22) .37	(.28) .42	(.33) .48	(.39) .54	(.44) .59	(.50) .65	(.55) .70	(.66) .81
6-0	72	(.12) .27	(.18) .33	(.24) .39	(.30) .45	(.36) .51	(.42) .57	(.48) .63	(.54) .69	(.60) .75	(.72) .87
7-0	84	(.14) .29	(.21) .36	(.28) .43	(.35) .50	(.42) .57	(.49) .64	(.56) .71	....	....	....

No. 66 in a series by W. L. Nelson, professor of petroleum refinery engineering, University of Tulsa

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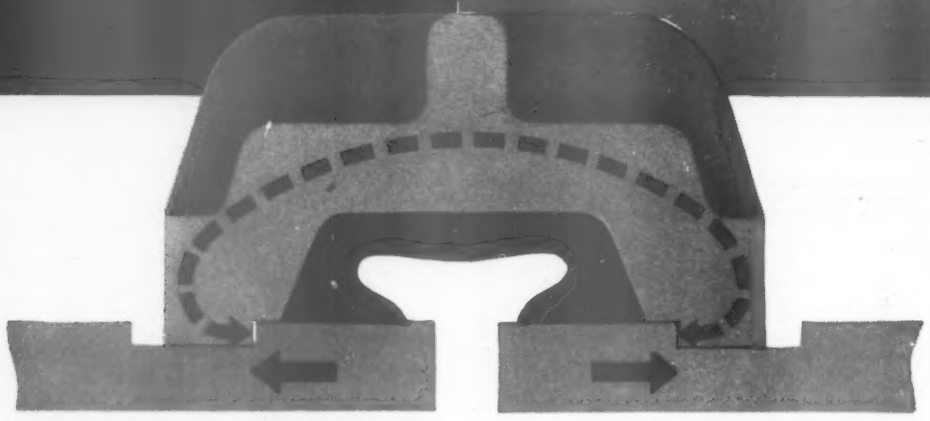

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Natural Gas

FPC Reopens Hearing on United Gas Application

WASHINGTON. — Federal Power Commission reopened its hearing October 24 on the application filed by United Gas Pipe Line Co., Shreveport, for authority to construct a 143-mile pipe line from the Carthage field in Texas to Monroe, La., with a daily capacity of 310,000,000 of natural gas.

The existing certificate, granted by FPC's order of July 5, authorizes United to transport through the Carthage-Sterlington line for Tennessee Gas & Transmission Co. a maximum of 114,000,000 cu. ft. a day from the Carthage field to Tennessee's Monroe compressor station, and to transport during the war emergency period a maximum of 65,000,000 per day for service to United's existing customers. Determination of the volume to be transported after the war period was reserved for consideration in the light of the circumstances then existing. Reopening of the hearing was deemed necessary since the company has filed a supplemental application requesting authorization to deliver additional quantities of gas to its present customers, Memphis Natural Gas Co., Southern Natural Gas Co. and Mississippi River Fuel Corp., and to sell gas to United Gas Corp. for resale in Calhoun, La.

Montana-Dakota to Acquire Additional Facilities

WASHINGTON. — Federal Power Commission has authorized Montana-Dakota Utilities Co., with principal offices in Minneapolis, to acquire the electric utility properties and other assets of Dakota Public Service Co. located in north-central South Dakota and southern North Dakota, by liquidation of the latter company immediately after the purchase of its securities and assumption of its liabilities, and to issue securities to finance the transaction.

Dakota Public Service, with headquarters in Huron, S. D., is a wholly-owned subsidiary of United Public Utilities Corp., and as preliminary Montana-Dakota is to purchase from United for a base price of $6,521,061 all of the subsidiary's outstanding securities, consisting of 8,370 shares of common stock without par value; $1,000,000 of first and refunding mortgage bonds due October 1, 1946; $2,500,000 of notes payable due July 1, 1949, and a $1,335,794 income note due July 1, 1949.

The FPC order states that the transaction should result in improved efficiency and economy of operation. There is no intercorporate relationship between Montana-Dakota and Dakota Public Service.

Public Service Commission of North Dakota has authorized Montana-Dakota to purchase the securities and acquire the electric utility properties of the Dakota company and to issue the bonds and common stock referred to in the FPC order.

Montana-Dakota carries on natural-gas and electric utility business in Montana, North Dakota and South Dakota, and a gas utility business in Wyoming. The service areas of Montana-Dakota and the Dakota company are contiguous and upon acquisition of Dakota's properties, Montana-Dakota proposes to interconnect the two systems.

Louisiana Loses Fight to Restrict End Use of Gas

BATON ROUGE.—Memphis Natural Gas Co., supported by Independent Natural Gas Association of America, has defeated Louisiana's effort to have the federal Government restrict the end use of natural gas. This is the effect of the action of U. S. Supreme Court in denying a writ of certiorari sought by the state.

Originally, Federal Power Commission dismissed an application of the Memphis company to extend its service so as to provide gas from Louisiana fields to the city of Memphis. Louisiana and coal interests had urged dismissal on the ground that the use to which the gas was to be put was an "inferior" one. Subsequently, on application of the Memphis company and INGAA, a rehearing was granted. FPC announced that evidence regarding so-called "inferior" and "superior" uses would not be heard, and after the rehearing it granted the application.

Louisiana then appealed to the Fifth Circuit Court of Appeals, and after that court refused to support the state, Louisiana petitioned the Supreme Court for the writ of certiorari. By denying this petition, the Supreme Court refuses to hear the case and thus makes effective the FPC final decision granting the Memphis application.

Hope Natural Plans New Facilities at Hastings

WASHINGTON. — Federal Power Commission has received testimony on an application of Hope Natural Gas Co. for authority to construct five steam-engine-driven compressors, of 2,000 hp. each and auxiliary equipment at its Hastings, W. Va., station and to obtain 12 existing compressor units aggregating 17,025 hp. Total over-all cost of the proposed project is estimated at $905,160.

Texas and Louisiana FPC Hearings Postponed

WASHINGTON.—New dates have been set by Federal Power Commission for its hearings at Dallas and New Orleans in the commission's natural-gas investigation. The New Orleans hearing, originally set for October 30, was postponed to November 12. The Dallas hearing, originally set for November 27, was postponed to December 10, at the request of Olin Culberson, chairman of the Texas Railroad Commission, who pointed out that if held as first planned the hearing would be interrupted by the Thanksgiving holiday.

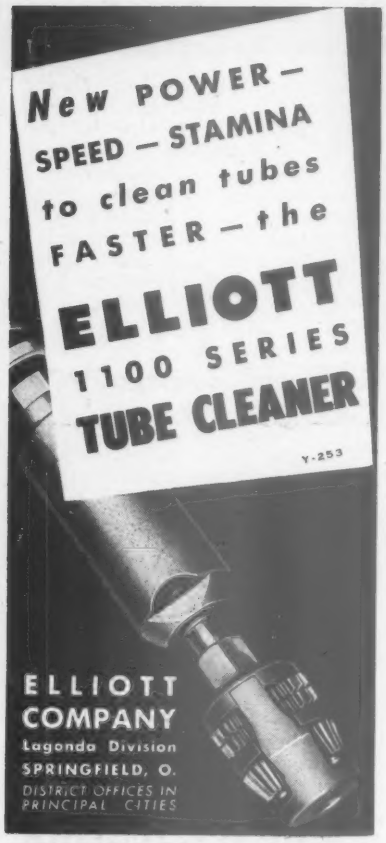
Natural Gasoline

Natural-Gasoline Output Continues Its Decline

WASHINGTON. — Daily average output of natural gasoline and allied products continued its gradual recession in July, according to Bureau of Mines, standing at 12,750,000 gal., compared with 12,894,000 in July. Substantial declines were recorded in the Texas Gulf and inland Louisiana districts. Oklahoma and East Texas registered minor gains. Production of natural gasoline and natural-gasoline mixtures increased, with continued heavy demand from refiners. Output of liquefied gases and finished gasoline dropped materially, and shipments were off.

PRODUCTION
(Thousands of gallons)

	August	July
Natural gasoline	190,019	188,623
Natural-gasoline mixtures	34,747	33,645
Raw condensate	32,429	34,308
Liquefied petroleum gases:		
Commercial butane-propane mixture	19,765	18,799
Normal butane	30,927	33,565
Propane	23,219	22,148
Other mixtures (L.P.G.)	15,734	16,303
Isobutane	13,849	14,114
Isopentane	11,985	13,084
Finished gasoline and naphtha	20,103	22,185
Other products	2,470	2,943
Total	395,247	399,717



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REFINING

Negotiations on for Sale of Eastern States DPC Plant

HOUSTON.—Negotiations are reported to be under way between Eastern States Oil Co. and the surplus property division of Reconstruction Finance Corp. for the sale or lease to Eastern States of the 100-octane refinery on Manchester Road. The plant was a war project built by Defense Plant Corp. and operated by the oil company. It is one of 17 such units declared surplus property. Another is the 100-octane refinery at Sweeny, Brazoria County, operated by J. S. Abercrombie & Co. and Magnolia Petroleum Co.

The Eastern States unit cost approximately $11,000,000, and the Sweeny refinery about $28,000,000.

W. I. Phillips, manager of the Houston RFC office, pointed out that both were built under emergency conditions, with overtime, inexperienced help, labor shortages and material delays. He estimated the cost would be about 40 per cent less under normal conditions.

An official of Eastern States said the fluid catalytic cracking unit is now being operated under an interim lease. This unit represents about 45 per cent of the total plant. It has a capacity of 3,140 bbl. of 100-octane gasoline daily. The property consists of 33 acres, occupied by 18 buildings with 40,000 sq. ft. of floor space. Equipment includes laboratory testing units, furniture and fixtures.

It was not known here whether the Sweeny plant is being considered for permanent use by the present operators.

Ingleside Butadiene Plant To Be Shut Down Soon

HOUSTON.—The Rubber Reserve Division of Reconstruction Finance Corp. has canceled its contract with Humble Oil & Refining Co. for the manufacture of butadiene at Humble's Ingleside, Tex., plant, the cancellation to become effective within 90 days from the date on which notice was received. The government agency asked that the plant be closed as early as practicable.

When the plant was constructed the cracking facilities in the refinery were converted into the buta-

Sketches of Plant Operators

A. P. (AL) FRAME, recently appointed vice president of Petroleum Advisers, Inc., technical and coordinating organization for Cities Service Co.'s petroleum and natural gas subsidiaries, has had a varied experience since joining the company's Ponca City, Okla., refinery staff as engineer in 1924. He was born in Nova Scotia. In 1928 he became superintendent of Cities Service Petty's Island plant, and in 1938 was made assistant director for all oil subsidiaries. In 1942 he became vice president and chief engineer of the new Cities Service Refining Corp. at Lake Charles, La., and served as director of the refining division, Petroleum Administration for War since August 1, 1944.

In his new position Frame will supervise refining operations for nearly 200,000 bbl. per day of plant capacity in eight refineries, and also all chemical research and development activities. E. H. Roy will aid Frame, as chief engineer to supervise refining construction and maintenance, and G. L. Mateer becomes technical director for all subsidiaries, handling research and development of processes and products, and all process engineering as well as actual refinery operations.

diene operation; thus, during the war years the refinery's principal output was butadiene and other war products. The refinery proper, excluding the war-product facilities, is now merely a topping plant. It is not practicable to operate with the butadiene section closed down, so as soon as the problems incident to the closing can be worked out, all the facilities will be shut down.

The company is trying to work out arrangements for the placing of Ingleside employes.

Hunt to Construct $500,000 Refinery at Tuscaloosa

TUSCALOOSA, Ala. — Contract has been awarded by Hunt Oil Co., of Dallas, for construction of a refinery here to cost $500,000. The principal output of the plant, which is to operate on oil from the Gilbertown, Ala., area, will be asphalt and asphaltic products, with gasoline and kerosene secondary.

Plant at Two-Mile Run To Be Modernized

FRANKLIN, Pa.—Socony-Vacuum Oil Co., Inc., plans expansion and modernization of its grease plant at Two-Mile Run, involving expenditure of $70,000. The program includes an addition to the grease house to be used as a shipping room and installation of new equipment to modernize the grease-making department.

The new equipment will include six kettles for grease making and an oil-fired circulating heater capable of producing high temperatures required in mixing components for special greases.

B. T. Perry, general manager, said it is planned to streamline the grease house. Conveyors, escalators, and motorized lifts to move grease-laden kettles about as desired will be installed. The new furnace will have automatic control and recording devices.

Socony-Vacuum acquired the Two-Mile Run plant, formerly owned by Franklin Railway Oil Co., in 1930.

Refiner-to-Refiner Ceilings On Oil Products Removed

WASHINGTON.—Office of Price Administration has removed the ceilings on refiner-to-refiner sales of petroleum products, with the exception of gasoline. The action, effective October 27, is in line with OPA's declared policy of freeing industry from price controls whenever it does not interfere with stabilization. Consumer prices are not affected.

Since the close of the war OPA has received many requests for elimination of all petroleum price ceilings. Independent Petroleum Association of America closed its recent Tulsa meeting by recommending immediate removal of petroleum price controls. Other groups and individuals have urged similar action.

OPA says it does not intend to allow price pressures to be brought on existing petroleum ceilings as a result of removal of ceilings on refiner-to-refiner sales. If such pressure should appear, OPA says orders or amendments reestablishing the ceilings will be issued. Chester A. Bowles, OPA administrator, previously announced that a lifting of petroleum price ceilings, generally, would be considered along with those of other industrials "around January 1."

Along with the directive on refiner-to-refiner sales, OPA announced that delivered-at-destination tanker ceiling prices for No. 6 fuel oil at principal eastern seaboard ports are established at specific amounts under the existing dollar-and-cent ceilings for f.o.b. sales.

Gulf Coast Gasoline Stocks Register Moderate Rise

HOUSTON.—Stocks of all gasolines and naphthas at Gulf Coast Refiners Association plants rose 81,294 bbl. in the first half of October, standing at 1,464,018 on October 15. Automotive gasoline inventories were 703,051 bbl., up 232,836. Total stocks of all products were 3,447,239 bbl., off 115,305. A year ago these totaled 4,174,375. Crude runs during the first 2 weeks of the month totaled 95,339 bbl., compared with 135,701 during the second half of September.

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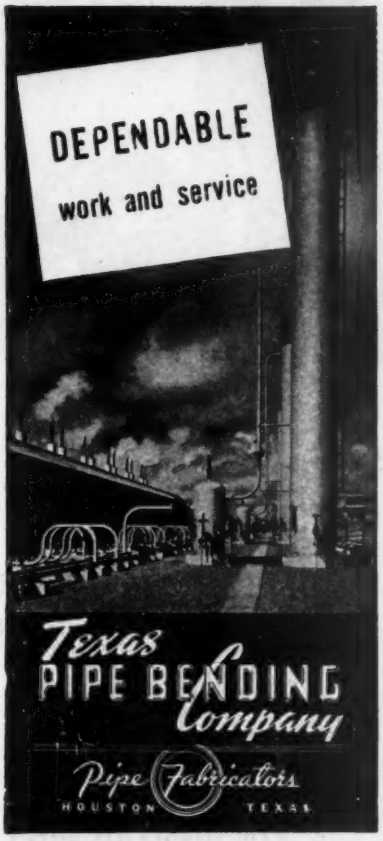

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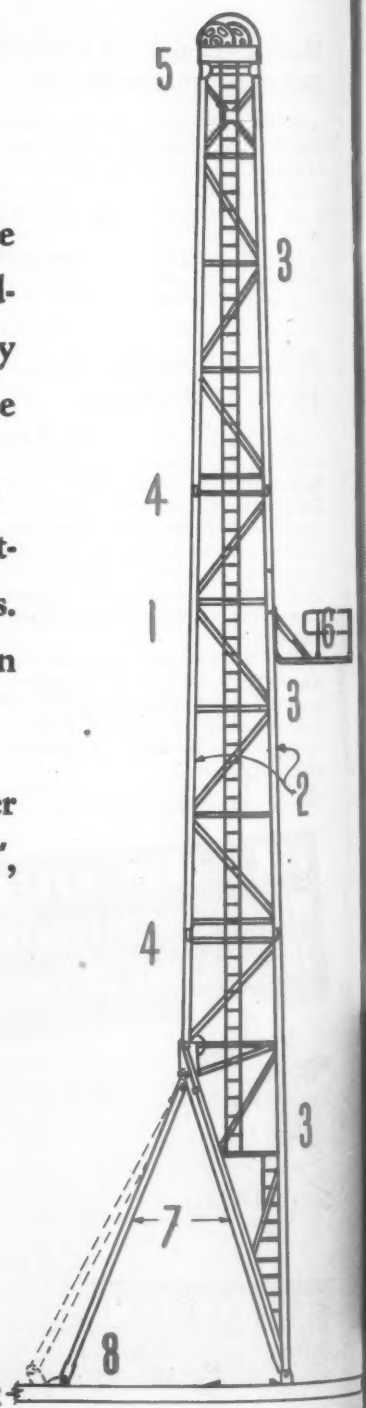
The Lee C. Moore portable Jackknife Cantilever Mast for rotary drilling is now available in 87′, 95′, 98′ and 127′ sizes.

SIZE	CAPACITY
87′ x 12′	300,000 lbs.
95′ x 12′ 6″	360,000 lbs.
98′ x 15′	450,000 lbs.
127′ x 15′	450,000 lbs.



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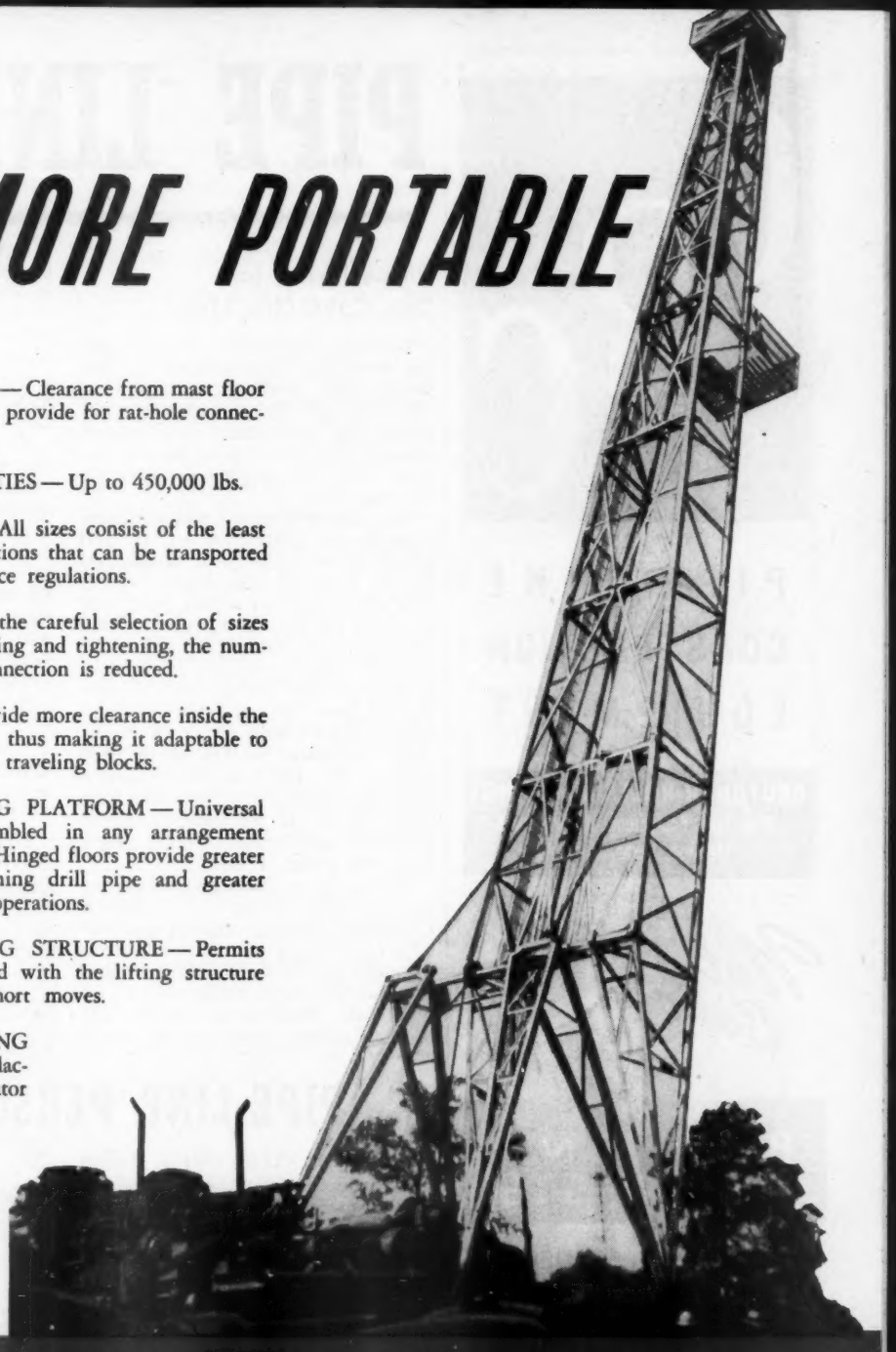

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PIPE LINES

Plans Made for Tex.-Calif. Gas Line

Southern California Gas Co. and the Southern Counties Gas Co. last week filed joint application with the Railroad Commission of California for permission to construct and operate 214 miles of natural gas pipe lines from Blythe to Santa Fe Springs, Calif.

The line will have an initial daily capacity of 175,000,000 cu. ft. and an ultimate capacity of 305,000,000 cu. ft., and will cost $15,000,000. It will connect with existing pipe lines at Santa Fe Springs for distribution throughout southern California.

F. S. Wade, president of the two companies, said the gas will be purchased from the El Paso Natural Gas Co. in Texas.

The proposed system of El Paso Natural Gas Co. has been designed to bring natural gas from the Permian Basin in western Texas to southern California through more than 900 miles of line.

El Paso is expected to be joined in the undertaking by Southern California Gas Co., subsidiary of Pacific Lightning Corp., although commitment of the California company has not yet been confirmed.

El Paso proposes to build a 26-in. transmission line with an initial capacity of 125,000,000 cu. ft. daily. It also plans to construct 117 miles of 24-in., 32 miles of 18-in., and 14½ miles of 14-in. gathering lines. These subsidiary lines would carry gas to a new compressor station to be built at the company's Jal No. 1 plant in Lea County.

El Paso also proposes to build a gas purification and dehydrating plant at Jal with a capacity of 105,000,000 cu. ft. daily.

Southern California Gas contemplates building a connecting line from the western terminus of the El Paso line about 210 miles to Santa Fe Springs, Calif., to tie in with its system to serve itself and Southern Counties Gas Co.

The El Paso end of the project is calculated to cost $25,400,000.

Guarico Project To Be Pushed

Equipment for completing the Puerto la Cruz-El Sombrero road of Creole Petroleum Co. to the Guarico area of Venezuela, will be leaving the United States in shipments to be made by Williams Brothers Corp., starting next week. Work is scheduled to commence in November for laying 250 km. beyond the section of road already built from Puerto la

PIPE-LINE PERSONALITIES

MARTIN E. KILPATRICK, elected president of Southern Pipe Line Co., to succeed A. Steve Clay, who was killed in an airliner accident April 14, grew up in Atlanta. He graduated from the law school of University of Georgia, where he played on the 1923-25 football teams. In law practice he was closely associated with Clay. Kilpatrick continues to be a member of the firm to which they both belonged and which is now known as Smith, Kilpatrick, Cody, Rogers & McClatchey. Kilpatrick entered his new position on being relieved of active duty as a lieutenant senior grade in the Navy, where he had served since October 1942 as air combat intelligence officer. He was attached to fighter and torpedo squadrons on three aircraft carriers. His units supported the invasion of Tarawa, Saipan, Guam, Iwo Jima, Palau, Okinawa, Formosa, and the Philippines.

Courtesy, The Atlanta Constitution

Cruz. A 100-ft. right-of-way is to be cleared. The first road to be completed will be 24 ft. wide with 4 in. of gravel. Later it is expected that the road will be widened and blacktopped. In planning the right-of-way provision has been made for the possible future location of pipe lines.

The contractor is shipping equipment for making concrete pipe for culverts and is preparing for taking contracts for making concrete blocks and for constructing buildings and docks.

O'Mahoney Hearing Set To Consider WEP

Problems relating to the use and disposal of the systems of War Emergency Pipelines, Inc., and other petroleum facilities will be considered at a hearing by the Senate special committee investigating petroleum resources and by the surplus property subcommittee of the Senate committee on military affairs, according to Sen. Joseph C. O'Mahoney, chairman of the former committee. The hearing will be held at 10:30 a. m., November 15, in the Senate Building, Washington.

The committee will receive opinions and recommendations concerning all petroleum facilities owned by the federal Government. The first witness will be a spokesman for a committee of the oil industry headed by W. Alton Jones, which has been preparing a report from the point of view of the industry.

Phillips Lays Lines In West Edmond Field

Phillips Petroleum Co. started laying operations on November 1 for 15 miles of gathering lines in the West Edmond field, Oklahoma. Pipe is of several diameters between 3½ and 20-in. The work was contracted by Bishop & Lock Construction Co.

Interstate Starts Gwinville Extension

Right-of-way is being cleared for Interstate Oil Pipe Line Co.'s project which includes the laying of 34 miles of 10-in. for an extension to Gwinville, Miss., and 2 miles of 6-in. The contractor, O. E. Dempsey Construction Co., has been moving a spread from Louisiana where it has been completing a section of United Gas Pipe Line Co.'s Carthage, Tex.-Sterlington, La., 24-in. line. Dempsey field headquarters have been established at Brookhaven, Miss., by Joe Work, superintendent.

Stanolind Completing Wind River Lines

Stanolind Pipe Line Co. is completing construction of 69 miles of 8-in. from Pilot Butte to Lysite, Wyo. This line together with 22 miles of 6-in. comprised the Wind River project contracted by R. H. Fulton Construction Co.

Ohio Fuel Lays to Bellefontaine, Ohio

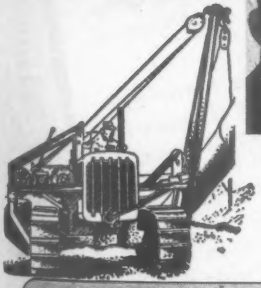
Ohio Fuel Gas Co. will lay 18 miles of 5-in. and 6-in. line from Urbana to the city of Bellefontaine, Ohio, which has an artificial gas plant. The right-of-way has been taken and work will start immediately.

Texas-New Mexico to Lay Dollar-Hide Line

Texas-New Mexico Pipe Line Co. is to lay a line from its Jal, N. M., station, to the recently discovered Dollar-Hide field in Southwest Andrews County, Texas. The line will be 6-in. and 8-in. pipe.

This area was opened to production several weeks ago when the Magnolia Petroleum Co. and Humble Oil & Refining Co. 1 Cowden, was completed to the Devonian.

PIPELINE "Know-how"



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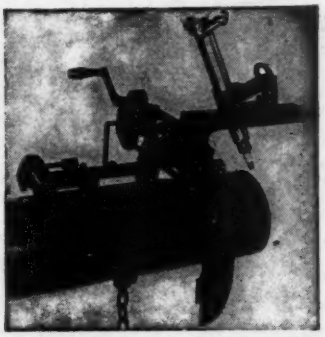

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Reduced reproduction of recent Parkersburg Rig & Reel Co. Advertisement

We had a hard time finding anyone for permission to photograph these units (Louisiana Coast above . . South Texas at right). The pumper has little reason for being around. Aside from periodical lubrication, refueling where internal combustion power is used, shutting down and starting where allowables require it, you'll find Parkersburg Pumpers are pretty well on their own. Thousands of them are cutting downtime and maintenance today. . . year periods of trouble-free operation are not unco... with these units. You can't beat Parkersburg's comb... of Quality materials and workmanship put into fi... neering design and backed by reliable field servic...

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One of the reasons why (as the ad above says) "the pumper has little reason to be around" has to do with the dependability of the drives on big OCS Pumping Units like the one operating down on the Louisiana coast. The drives are Diamond Roller Chains.

Machinery builders and operators know that the long experience of DIAMOND engineers in oil field drive applications, plus the great reserve strength and long-life dependability of the Chains, assure trouble-free, low-cost, steady performance of the driven machinery. Constantly increasing use of DIAMOND Drives during 25 years of oil field applications is good proof of their wide preference by leaders in the industry. . . . DIAMOND CHAIN & MFG. CO., 475 Kentucky Avenue, Indianapolis 7, Indiana. Tulsa Office: 2238 Terwilleger Blvd.

DIAMOND ROLLER CHAINS

Exploration and Drilling

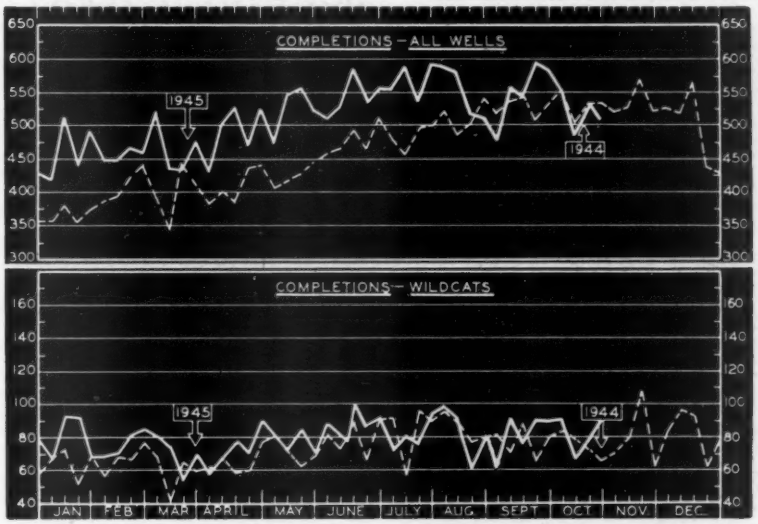
Week's Highlights

THE Mattoon field in Coles County, Illinois, has been picking up momentum for some time, but results in two outpost wells promise to make this a hotspot. The wells are M. H. Richardson 1 Powell, SE NE SE 10-12n-7e, 1¾ miles north of nearest production, and Victor Scheef 1 Bresee, NE NE SE 15-11n-7e, 2½ miles south of production.

The north extension, the Powell well, originally passed up promising indications in the Cypress sand, but put in a Securalloy window for later testing. It was drilled to 1,999 ft. in the Aux Vases, shot with 30 quarts, and filled up with some oil; drilled deeper to 2,007 ft., filled up with 35 ft. of fluid, 10 per cent water, in 1 hour; plugged back to 1,770-1,806 ft., removed window opposite Cypress and started swabbing to remove acid water. The well started flowing and is now making 11 bbl. per hour natural.

The Bresee test, attempted south extension, on drill-stem test at 1,934-35 ft., in the Aux Vases, open 1 hour, recovered 30 ft. of oil, 60 ft. of oil-cut mud, no water. Later reports indicate it was drilled to 2,035 ft., found top of Aux Vases sand at 1,961 ft., and reported saturation at 1,965-73 ft., tight sand at 1,973-84 ft. Electric log, however, is reported to have shown best pay possibilities at 1,974-84 ft. Now waiting on cement.

The Mattoon structure, 6 miles long and 2 miles wide, is located on the northwest flank of the Coal Basin. Sand conditions are erratic in the area and original play was on the east or basinward side of the



Solid line charts current weekly completions, service wells in Eastern area included

WEEKLY WELL COMPLETIONS . . . WEEK ENDED OCTOBER 27, 1945

	Total of all wells					Cum. to date		Wildcat completions and discoveries					Cumulative total, 1945				
	Comp.	Oil	Gas	Dry	Footage	1945	1944	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	32	16	0	*16	54,700	1,209	1,323	0	0	0	0	0	0	0	0	0	0
Pennsylvania	73	38	2	†33	121,180	3,371	3,477	0	0	0	0	0	0	0	0	0	0
West Virginia	17	1	9	7	49,201	668	725	0	0	0	0	0	0	0	0	0	0
Ohio	30	9	13	8	80,399	797	831	0	0	1	0	1	0	0	13	52	65
Indiana	4	3	0	1	8,882	161	213	1	0	0	0	1	6	0	0	23	29
Kentucky	6	3	1	2	10,739	439	617	1	0	0	0	1	21	0	4	45	70
Illinois	41	28	0	13	103,379	1,469	1,558	1	0	0	9	10	42	0	0	261	303
Michigan	15	6	2	7	33,006	620	552	2	0	1	6	9	11	0	4	231	246
Kansas	42	17	9	16	132,067	1,419	1,504	1	0	0	8	9	31	0	12	281	324
Neb., Mo., Iowa	0	0	0	0	0	19	33	0	0	0	0	0	0	0	0	14	14
Oklahoma	32	15	2	15	98,940	1,955	1,481	2	0	0	4	6	73	3	15	292	383
Texas	114	61	10	43	502,241	5,882	4,602	5	0	0	23	28	173	13	49	1,042	1,277
North Central	28	16	0	12	88,313	1,797	1,203	2	0	0	6	8	67	0	5	362	434
West	27	16	0	11	135,648	1,447	1,300	1	0	0	4	5	45	1	0	213	259
Panhandle	9	3	6	0	27,402	460	228	0	0	0	0	0	0	0	1	6	7
Eastern	11	5	2	4	61,515	290	264	0	0	0	3	3	5	7	2	72	86
Gulf Coast	28	17	1	10	174,131	1,358	1,040	2	0	0	4	6	42	4	32	235	313
Southwest	11	4	1	6	33,232	530	567	0	0	0	6	6	14	1	9	154	178
Louisiana	17	8	4	5	112,969	867	656	1	0	0	3	4	27	3	6	103	139
Northern	9	4	3	2	41,381	356	264	1	0	0	1	2	8	1	6	58	73
Southern	8	4	1	3	71,588	511	392	0	0	0	2	2	19	2	0	45	66
Arkansas	4	1	0	3	22,613	149	181	0	0	0	2	2	1	0	0	32	33
Mississippi	12	9	0	3	75,715	307	116	0	0	0	2	2	5	0	0	100	105
Southeastern	0	0	0	0	0	47	44	0	0	0	0	0	1	0	1	32	34
Montana	4	4	0	0	10,899	263	295	2	0	0	0	2	9	0	0	23	32
Wyoming	9	5	2	2	31,282	181	143	1	0	0	2	3	15	0	1	40	56
Colorado	1	0	0	1	6,350	44	30	0	0	0	1	1	1	0	1	9	11
New Mexico	11	7	2	2	33,547	352	330	0	0	1	2	3	10	0	6	55	71
California	42	30	3	9	196,859	1,879	1,654	1	0	0	8	9	4	0	2	196	202
Total United States	506	261	59	186	1,702,968	22,098	20,365	18	0	3	70	91	430	19	114	2,831	3,394
Total previous week	532	278	45	209	1,969,532	21,592	19,812	6	0	0	74	80	412	19	111	2,761	3,303
Total Oct. 28, 1944	528	291	51	186	1,589,442	20,365	14,512	11	0	4	61	76	371	24	107	2,648	3,150

Service wells included: *16, †29.

structure, with poor results. The new play, with good results, is on the west side, toward the rim of the basin.

About 15 strings of tools are now active. Approximately 2,500 bbl. of oil daily is being shipped, 2,250 bbl. via tank car from Loudon Pipe Line Co. loading rack, and 250 bbl. by truck from field to nearest point on Texas Co. pipe line. The latter company is reported planning a connecting line from the field to its Hayworth-Lawrenceburg main line.

SOUTH LOUISIANA

North Cankton Field Extended Eastward

NEW ORLEANS.—The North Cankton field of St. Landry Parish has been extended eastward into Lafayette Parish by Shell Oil Co., Inc. 1 F. A. Broussard, 65-8s-4e. Drilled to a total depth of 11,155 ft. with 5½-in. pipe set to 11,086 ft., completion was made through perforations at 10,642-656 ft. It flowed 560 bbl. per day through a 12/64-in. choke, gas-oil ratio 1,160 to 1, tubing pressure 2,050 lb., gravity 35°, no water. A test through perforations at 11,025-28 ft. had shown gas and condensate but retainer was set at 10,978 ft. for the completion in the 10,642-ft. sand.

Humble Oil & Refining Co. continues deep drilling activities. Its 1-B Mrs. J. A. Bel, 33-5s-4w, wildcat in the Oberlin area in Allen Parish was preparing to core ahead from 12,060 ft. in hard sandy shale. Its 1 Warren Kearney in the Bayou Carlin area of St. Mary Parish, is drilling ahead from 12,700 ft. in shale and sand streaks. Also in St. Charles Parish, Humble 1 State-Lake Salvador, wildcat in Lake Salvador, was conditioning mud at 12,315 ft. in shale.

There were 21 new locations reported this week, 3 being wildcats, 1 each in Cameron, Rapides, and Terrebonne parishes, all three contracted to be drilled to 10,000 ft. or deeper. Of the eight completions two were dry wildcats, one each in Cameron and East Baton Rouge parishes. There were four oil producers in proven areas, one each in Beauregard, Jefferson, Plaquemines, and Vermilion parishes, with a total of 773 bbl. initial production.

SOUTH LOUISIANA WILDCAT FAILURES

Cameron Parish: Continental and Yegua Corp. 2 A. Dobbertine, 9-15s-14w, dry at 13,008 ft.

East Baton Rouge Parish: Bankhead Oil and Robert Y. Walker 1 Kleinpeter, 58-7s-1e, dry at 5,710 ft.

SOUTHWEST TEXAS

Bee County Discovery Gets Second Producer

CORPUS CHRISTI.—The second well drilled in the recently discovered Theis field, Bee County, Tom Graham 3 Albert Theis et al, is a producer. Located about 14 miles northwest of Beeville, this well flowed approximately 80 bbl. per day through a 7/16-in. choke, tubing pressure 180 lb., through perforations at 3,548-60 ft. The total depth is 3,589 ft. with 5½-in. casing set on bottom. The discovery well, Tom Graham 1 Theis et al, produced 105 bbl. per day through a 3/16-in. choke through perforations at 3,573-82 ft.

Atlantic Refining Co. 1 James E. Ewing, a wildcat 3 miles southwest of Robstown, Nueces County, in M. Lopez de Herrera Grant, Section 46, blew out from around 8,000 ft. but is now under control.

There were 17 new locations reported this week with 6 being wildcats, 2 in San Patricio County, 1 each in McMullen, Nueces, Starr, and Zapata counties. Of the 30 completions this week 8 were wildcats, all dry, 3 in McMullen County, 1 each in Karnes, Milam, Victoria, Webb, and Williamson counties. Jim Wells County led this week reporting eight completions with Seeligson and Tijerina fields each receiving three producers.

SOUTHWEST TEXAS WILDCAT FAILURES

Karnes County: Southern Minerals Corp. 1 M. A. Zindt, W. M. Hunter Survey, Abstract 317, 1½ miles east of Gillette, dry at 6,151 ft.

McMullen County: John F. Camp 1 J. W. Atkinson, Section 125, AB&M Survey, 2 miles north of Loma Alta field, dry at 2,642 ft.

Plymouth Oil 1 Harry Ezzell, Hayes Ezzell Subdivision, Section 8, 6 miles southwest of Calliham, junked at 879 ft.

Sunray Oil Co. 1 J. A. Bracker, Jas. Jean Survey, Abstract 282, 3 miles southeast of Tilden, dry at 6,515 ft.

Milam County: J. C. Davis heirs 1 fee, J. J. Acosta Survey, 8 miles northwest of Rockdale, dry at 1,002 ft.

Victoria County: L. D. Cain 1 A. W. Carpenter, Thos. G. Burnham Survey, Abstract 33, 6 miles south of Telferner, dry at 4,503 ft.

Webb County: Coastal Refineries, Inc. 1 Bruni estate, Albercas Grant, Block 72, 12 miles south of Mirando City, dry at 2,020 ft.

Williamson County: H. W. Snowden 1 Annie Killdorf et al, Geo. M. Reese Survey, 2 miles southwest of Taylor, dry at 595 ft.

TEXAS GULF COAST

Two Extensions, Two New Pays Are Features

HOUSTON.—Thompson field in Fort Bend County has been extended to the west by Cecil Hagen et al 3 Wolters, in Samuel Kenedy Survey, Abstract 44. This well flowed a potential of 224 bbl. in 24 hours through an 11/64-in. choke, through 24 perforations at 5,412-20 ft., tubing pressure 320 lb., casing pressure 1,140 lb. The gas-oil ratio was 425 to 1, with gravity of 24°. Total depth is 5,445 ft., and first sand showing oil was found at 5,369 ft.

A new sand at old South Liberty field in Liberty County has been opened by F. J. Bashara 1 Pickett, an old well in M. G. White Survey, which is completed in a new sand at 3,600 ft. Total depth is 3,862 ft., perforated with 52 holes at 3,600-18 ft., and flowed a potential of 87 bbl. per day through a 5/32-in. choke, tubing pressure 250 lb., casing pressure 400 lb., gas-oil ratio 200 to 1, and gravity 41°.

Potential has been run on Magnolia Petroleum and Abercrombie Co. 1 Peter Studer, an east extension to Old Ocean field, Brazoria County. It flowed 295 bbl. per day of 46-gravity oil through a 16/64-in. choke. Gas-oil ratio was 41,171 to 1, tubing pressure 3,500 lb., no water. This is a ¾-mile extension in the S. F. Austin 7½ League, about 2 miles east of Sweeney, and will open up considerable new productive territory on east side of the big field.

Humble Oil & Refining Co. 10 Edward F. Milo et al, deep test at Tomball field, Harris County, C. N. Pillot Survey, is shut down for repairs at total depth of 14,033 ft. in sandy shale. This is the deepest test for oil drilled in Harris County and one of the few tests in the world to drill below 14,000 ft.

There were 19 new locations reported this week, 4 being wildcats, 1 each in Fort Bend, Grimes, Matagorda, and Montgomery counties. Of the nine completions four were wildcats, two being extensions to old fields, and two dry. Fayette County led with four completions reported.

UPPER GULF COAST SUCCESSFUL WILDCATS

Fort Bend County: West extension to

DAILY AVERAGE PRODUCTION FOR WEEK

	Oct. 27 crude oil	Distillate allied products	October PAW quota all oils	Oct. 20 crude oil
Alabama	100	.....	500	50
Arkansas	75,250	5,400	80,400	75,000
California	845,750	60,970	946,970	817,750
Colorado	13,550	.....	12,000	12,800
Eastern	62,400	6,300	72,500	62,350
Florida	150	.....	.....	150
Illinois	212,350	12,000	212,000	205,550
Indiana	13,700	.....	13,000	13,650
Kansas	264,950	4,500	278,500	273,950
Kentucky	29,750	2,600	30,600	28,950
Louisiana	353,000	42,000	392,000	356,400
North Louisiana	68,000	.....	.....	71,400
South Louisiana	285,000	.....	.....	285,000
Michigan	44,250	800	47,800	42,100
Mississippi	52,450	.....	47,000	52,000
Montana	23,550	300	23,800	23,500
Nebraska	800	.....	1,000	800
New Mexico	101,500	6,800	106,800	102,500
Oklahoma	367,500	28,000	408,000	361,250
Texas	1,711,700	166,000	2,034,000	1,701,700
East Texas	302,000	.....	.....	302,000
East Central Texas	117,700	.....	.....	107,700
North Central Texas	134,300	.....	.....	134,300
Texas Panhandle	88,000	.....	.....	88,000
West Texas	396,000	.....	.....	396,000
Southwest Texas	296,800	.....	.....	289,800
Texas Gulf Coast	403,900	.....	.....	403,900
Wyoming	97,300	3,500	96,700	97,400
Total United States	4,270,000	339,170	4,803,570	4,227,850
Change from previous week	up 42,150			

Total production January 1-October 27, 1945 ..... 1,414,567,225 bbl.
Same period last year ..... 1,366,077,600 bbl.

Thompson field—Cecil Hagen et al 3 Wolters, Samuel Kenedy Survey, Abstract 44, west of 1 Wolters well, TD 5,445 ft., perforations 5,412-20 ft., PT 224 bbl. per day through an 11/64-in. choke, gas-oil ratio 425, tubing pressure 320 lb., casing pressure 1,140 lb., gravity 24°, no water.

Brazoria County: East extension to Old Ocean field: Magnolia Petroleum and Abercrombie Oil 1 Peter Studer et al, S. F. Austin 7⅞ League, 2 miles east of Sweeney, TD 10,957 ft., perforations 10,830-50 ft., PT 295 bbl. per day through a 16/64-in. choke, gas-oil ratio 41,171 to 1, tubing pressure 3,500 lb., gravity 46°, no water.

UPPER GULF COAST WILDCAT FAILURES

Fayette County: M. E. Davis 1 C. M. Janda, Fayette County School Land Survey, Section 64, 2 miles north of Swiss Alps, dry at 6,011 ft.

Jackson County: Louis Crouch 1 M. C. Jeffrey, Morris & Cummings Survey, Abstract 233, 9 miles southeast of Ganado, dry at 6,609 ft.

MICHIGAN

Wildcats for Week Include 2 Oil, 1 Gas

SAGINAW.—Two small wildcat oil producers and one small gas well were among the 15 oil and gas completions in Michigan in the past week as 21 new locations were announced and 6 of the completions brought oil. Best well was the S. L. McCall 1 Wolven in Section 25, Algoma Township, Kent County, flowing 360 bbl. in 6½ hours after bein acidized. The slow decline in Michigan crude production continues. Oil and Gas Association figures gave September production as 1,325,520 bbl., a daily average of 44,184 bbl. from 3,508 wells. Six of the nine wildcat completions for the week were dry holes. New permits for drilling go to 12 counties, 4 for Allegan, 3 each for Arenac and Montcalm, 2 each for Isabella and Mecosta, 1 each for Van Buren, Genesee, Gladwin, Ottawa, Kent, Huron and Newaygo.

MICHIGAN SUCCESSFUL WILDCATS

Montmorency County, Avery Township: E. R. Morris 1 Patterson and White, SE SW SW 10-30n-3e; pumping 25 bbl. weekly; TD 2,510 ft.

Osceola County, Evart Township: Sun Oil Co. 1 Boyd and Jaguszewski, NW 19-17n-8w; 150,000 cu. ft. gas; TD 1,492 ft.

Roscommon County, Roscommon Township: Eugene Hilliard D-1 State-Roscommon, E SE SE 19-21n-3w; flowing 35 bbl., acidized in Dundee; TD 3,185 ft.

MICHIGAN WILDCAT FAILURES

Bay County, Garfield Township: Eugene Hilliard and K. A. Fox 1 J. Vanderbrink, SW SE NW 13-16n-3e; dry in Dundee; TD 3,531 ft.

Isabella County, Gilmore Township: Sohio Petroleum 1 Gilmore Gas unit, SE NW NW 25-16n-5w; dry TD 1,888 ft.

Sherman Township: C. W. Collin 1 C. R. W. Southwick, SE SW NE 9-15n-6w; dry; TD 1,765 ft.

Lapeer County, Deerfield Township: Clarence Wilcox 1 Robert Taylor, NW NW NE 20-9n-10e; dry in Dundee; TD 2,460 ft.

Mecosta County, Morton Township: West Michigan Consumers Co. 1 State-Minkel et al, NE 18-14n-8w; dry, TD 1,341 ft.

Missaukee County, Caldwell Township: Gordon Oil and Sohio Petroleum 1 Missaukee Lakes Land Co., SE SW SW 29-32n-8w; dry in Monroe; TD 3,859 ft.

APPALACHIAN FIELD

Slab Fork District Gets Good Gas Well

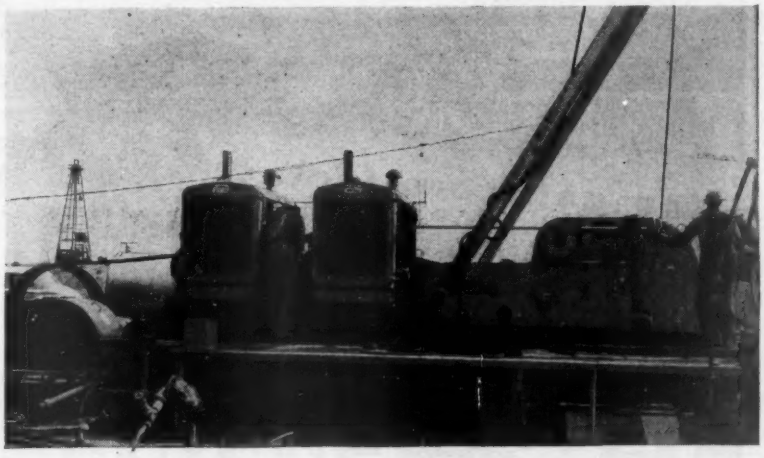
PITTSBURGH.—Completions in this area were few and small. New work listed totals nine of which eight are tests located in Armstrong, Greene, Indiana, Jefferson, Washington and Westmoreland counties, the most interesting being in North Strabane Township, Washington County.

In West Virginia, Godfrey L. Cabot, Inc., completed a good gas well in Slab Fork district, Raleigh County, No. 1,178 Piney Coking Coal Co., which gaged 2,322,000 cu. ft. natural final open flow from the Weir sand. The Big lime was logged at 2,515-3,120 ft.; Injun 3,120-47 ft.; Weir 3,400 ft.; gas 3,408-13 ft.; gas 3,418-22 ft.; rock pressure 685 lb. 16 hours; total depth 3,422 ft.

In Jackson County, Columbian Carbon Co. completed 804 Delbert E. Cole in Ravenswood district, good for 1,637,000 cu. ft. gas, after shot from the Oriskany sand, 4,927-5,000 ft.; gas 4,930 ft.; shot 4,927-67 ft.; total depth 5,007 ft.

In Preston County, the wildcat of William E. Snee on Harry Sisler farm in Portland district, is now drilling at 6,086 ft., or 169 ft. below the top of the Oriskany sand. At 6,064-86 ft., a small amount of gas was picked up, bringing the total from the Onondaga chert and the Oriskany to about 45,000 cu. ft. Drilling is expected to continue to the dolomite.

New locations in the state totaled 12 scattered in Boone, Calhoun, Nicholas, Raleigh, Ritchie, Roane, Wayne and Wyoming counties.



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ILLINOIS

Mattoon Area Being Explored in 3 Townships

MATTOON.—The Mattoon pool in Coles County, and the territory on all sides of the pool, are in the midst of a red-hot play for extensions and possible new pools as exploratory work continues in Townships 11, 12 and 13 north, and Range 7 east.

The pool, which at the close of the past week, had 26 oil wells, producing about 3,100 bbl. a day, was extended during the week by T. B. Dirickson 1 Linder-Pinnell, NE SE NW 27-12n-7e, which started at 209 bbl. per day from Aux Vases sand at 1,996-2,005 ft.

Carter Oil Co. 1 Ganley, SW NW NW 2-11n-7e, swabbed 224 bbl. of oil in 11 hours following a 100-qt. shot in Cypress sand at 1,790-1,822 ft. and 100 qt. in Aux Vases sand at 1,966-77 ft. It was not yet a completion. Carter's 1 Uphoff, NW SW NW 2-11n-7e, and 1 Tynan estate, SW SW SW 35-12n-7e, were also showing oil.

Carter Oil Co. 3 Shatto, SW SE SW 20-3n-3e, in the Noble pool, Richland County, swabbed 323 bbl. in 24 hours from McClosky lime at 3,000-19 ft., which had been acidized.

In the North Boos field in Jasper County, Pure Oil Co. and J. J. Lynn 1 J. Wagner-A, C N½ SE SW 9-6n-10e, started at 243 bbl. on the pump from acidized McClosky lime at 2,776-81 ft.

Forty-three new operations were reported in the past week, of which the following were wildcat tests: Shulman Bros. 1 Bunton, C W½ NW NE 31-7n-10e, Jasper County; Paul Doran 1 Wharton, NW SW NW 12-6n-4e, Effingham County; Powell & Rea 1 C. A. Allen, SW SW NW 5-2n-2w, Clinton County; J. J. Lynn 1 J. Waughtell, C E½ NE SE 1-2n-9e, Richland County; Superior Oil Co. 1 L. McNeilly et al, NW NW SE 31-1n-2e, Marion County; Algonia Oil Co. 1 A. Kennedy, NE NW SE 6-1s-1e, and John Darlan 1 C. B. & Q. land, SW NW NE 21-1s-1e, Jefferson County.

ILLINOIS SUCCESSFUL WILDCAT

Coles County: T. B. Dirickson 1 Linder, NE SE NW 27-12n-7e, Aux Vases sand 1,996-2,005 ft., TD 2,007 ft., 209 bbl. in 24 hours. Extends Mattoon field.

ILLINOIS WILDCAT FAILURES

Coles County: T. B. Dirickson 1 F. E. Wilson, SE SE SE 17-11n-7e, dry at 2,421 ft. Glen Dean 1,990 ft., Benoist 2,296 ft., Aux Vases 2,356 ft., McClosky lime 2,405 ft.

Homer Luttrell 1 Clayton-Hayborn, NE SE NW 2-13n-7e, dry at 1,861 ft. Glen Dean 1,529 ft., Barlow 1,607 ft., Aux Vases 1,765 ft., McClosky 1,844 ft.

Cumberland County: T. B. Dirickson 1 Bergamon, SW SW SW 5-10n-7e, dry at 2,294 ft. Glen Dean 1,841 ft., Benoist 2,054 ft., Aux Vases 2,122 ft., McClosky 2,221 ft.

Hamilton County: Magnolia 1 Biggerstaff, NE NE SE 34-3s-6e, dry at 3,552 ft. Upper Glen Dean 2,764 ft., Cypress 3,092 ft., Aux Vases 3,340 ft., McClosky 3,481 ft.

Bond County: R. F. Smith 3 Scharf, NE SE SW 27-7n-4w, dry at 624 ft. No showing in a sand at 561-99 ft.

J. H. Roberts 1 Hoiles, SW NW NE 14-4n-3w, dry at 1,169 ft. Tar Springs 798 ft., Cypress 1,027 ft., Benoist sand 1,159 ft.

Cass County: W. Vette 1 Carls, NW SE SW 30-18n-11w of 4th p.m., dry at 713 ft. Devonian lime top at 663 ft.

Jasper County: J. J. Lynn 1 H. A. McGovern, SW SW SW extended Section 7-6n-11e, dry at 2,770 ft. Tar Springs 2,104 ft., Cypress 2,356 ft., Benoist 2,527 ft., Aux Vases 2,578 ft., McClosky 2,681 ft., St. Louis 2,754 ft.

Marion County: C. Baldwin 1 Kerwin, NW NW SW 28-3n-1e, dry at 822 ft. Petro sand top 797 ft.

N. CENTRAL TEXAS

7,000-Ft. Wildcat Is Scheduled for King Co.

WICHITA FALLS.—Superior Oil Co. of California will drill a 7,000-ft. wildcat in western King County. It is 1 Pitchfork Land & Cattle Co., 330 ft. from the north and west lines of Block 17, John H. Gibson Survey, 12 miles northwest of Guthrie. Ohio Oil Co. 1 Pitchfork, Block 1, Somervell County School Land Survey, another western King County wildcat, 10 miles northwest of Guthrie, was drilling below 6,041 ft. in lime.

Magnolia Petroleum Co. 1 Bush Bros., J. McKerley Survey, ½ mile north of Sivell's Bend, Cooke County, perforated with 80 shots at 6,680-6,700 ft. and ran tubing. It was swabbed and recovered oil and oil-cut mud. The well would not kick off. Operator was preparing to re-perforate. Ohio 1 L. A. Gibson, Section 484, Block H, W&NW Survey, Childress County wildcat 6 miles southeast of Childress, was drilling below 7,270 ft. in shale and lime.

Wichita County has six field completions and Montague County three. Wichita County reported nine field locations and Archer County eight.

NORTH CENTRAL TEXAS SUCCESSFUL WILDCATS

Montague County: New oil pool—Venmex Oil 1 A. E. Beakley, Blk. 21, M. Garnett Sur., ½ mi. NE Belcherville, elev. 897 ft., flowed 930 bbl. day through ¾-in. choke, perf. 5,346-56 ft. Caddo, gravity 44°, gas-oil ratio 650, TD 5,913 ft.

Extension to old oil pool: Venmex 1 Wm. Fay Kingsbury, B. Anibal Sur. A-1058, ¾ mi. N Hildreth pool, elev. 954 ft., flowed 1,609 bbl. day through ¾-in. choke, perf. 6,030-62 ft. Caddo, gravity 41°, gas-oil ratio 650, TD 6,197 ft.

NORTH CENTRAL TEXAS WILDCAT FAILURES

Archer County: Perkins & Cullum 1 W. and C. Mankins, Block 2, SPRR Sur. A-1101, 2 mi. E Mankins, dry, TD 4,251 ft.

Frank Wood et al 1 C. L. Abercrombie, Sec. 152, Harris Subd. Club Ranch, 1 mi. S and W Archer City, elev. 1,034 ft., Ellenburger 5,540 ft., dry, TD 5,644 ft.

Young County: Fain & McGaha 1 Snider, R. Wilson Sur. A-1276, 2 mi. N Markley, elev. 1,032 ft., dry, TD 4,246 ft.

WEST CENTRAL TEXAS

ABILENE.—W. R. Skeen 1 B. Hatchett, Section 33, Orphan Asylum Lands Survey, is a prospective Ellenburger discovery for Stephens County. Ellenburger was topped at 4,180 ft. On a drill-stem test at 4,210-28 ft., 60 ft. of oil and gas-cut drilling mud with no water was recovered. Total depth is 4,228 ft., and operator was running 5-in. casing. A new 5,100-ft. wildcat for Jones County, 8 miles north of Leuders, is M. M. Travis 2 A. M. Heranius, 330 ft. from the east line and 405 ft. from the south line of Heranius tract, Section 164, BBB&C Survey.

Reddin field, Jones and Taylor counties, had two completions. Eastland, Palo Pinto and Taylor counties each had one new field location.

WEST CENTRAL TEXAS WILDCAT FAILURES

Jones County: M. M. Travis et al 1 A. Nobles, B. Traveno Sur. No. 190, 4 mi. E Hawley, elev. 1,616 ft., lower Hope 2,147 ft., dry, TD 2,175 ft.

West Central Drilling 1 J. F. Winters, Lot 2, J. Winters Sur. No. 138, 2 mi. SW Hodges, elev. 1,742 ft., Flippen 2,321 ft., dry, TD 2,490 ft.

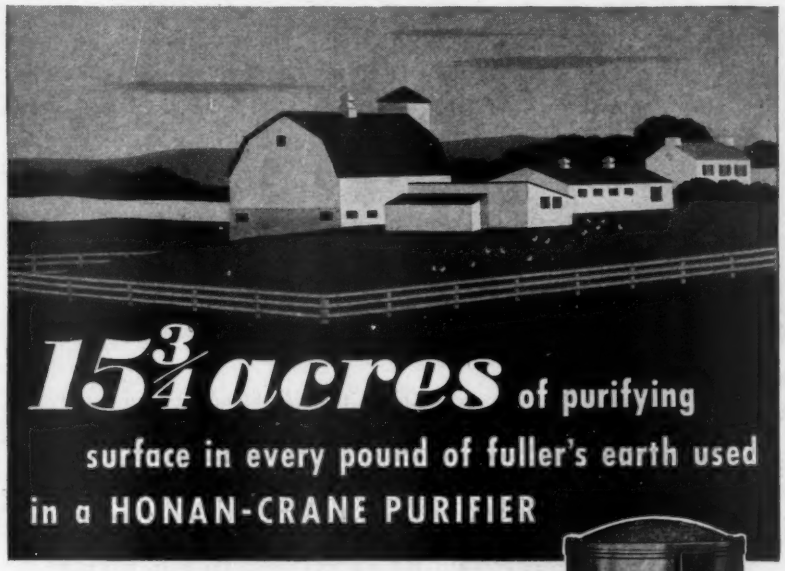
Mills County: A. R. Forster, Tr. 1 J. A. Holland estate, Section 1, T&NO Sur., 12 mi. NW Goldthwaite, elev. 1,371 ft., Ellenburger 2,363 ft., dry, TD 2,721 ft.

EASTERN TEXAS

South Tyler Pool Gets Second Producer

DALLAS.—The South Tyler pool of southern Smith County has its second producer in Phillips Petroleum Co. 1 Hairston-Johnston, John Hope Survey, north offset to the discovery. The well gaged 192 bbl. of 53-gravity oil in 24 hours through 10/64-in. tubing choke through perforations at 9,860-70 ft. in James lime section. Sinclair Prairie Oil Co. 1 Schofner, Wm. Dickerson Survey, deep test on the south end of the Chapel Hill structure of eastern Smith County, with total depth of 13,577 ft., continued to cut stuck drill pipe.

Stewart Oil Co. 1 Brown estate, Joseph Watkins Survey, 3½ miles northeast of Jefferson, Marion County, has been completed as a wet gasser from the Dees zone of the Rodessa section through perforations at 6,198-6,210 ft. Total depth is 7,200 ft. Stanolind Oil & Gas Co. 1 Cole, Taylor Survey, wildcat 5 miles south and slightly east of Marshall, Harrison County, was drilling below 5,690 ft. in the Lower Glen Rose. M. E. Davis 1 Thomas, William B. Horne Survey, San Augustine



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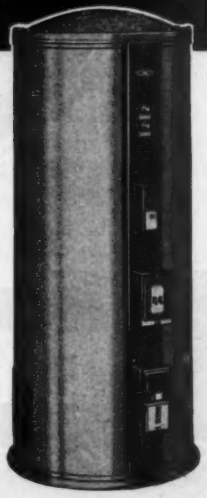

THE exceptional filtering capacity of Honan-Crane Purifiers is due in large part to Honan-Crane's ability to use loose fuller's earth as the filtering medium. A Honan-Crane Purifier for an average size Diesel would contain approximately 88 lbs. of fuller's earth, providing 1,386 acres of filtering surface.

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County wildcat 5 miles west of San Augustine swabbed 25 per cent asphaltic oil and the remainder salt water through perforations at 8,635-50 ft. Total depth is 9,920 ft.

Hawkins field, Wood County, had three completions this week. Carthage field, Panola County, reported six new locations and Hawkins field three.

EASTERN TEXAS WILDCAT FAILURES

Houston County: Geier Bros. and Jackson 1 J. R. Smith, E. Wingate Sur., 5 mi. NW Grapeland, elev. 507 ft., Austin 5,900 ft., Woodbine 6,110 ft., dry, TD 6,153 ft.

Hunt County: L. A. Helms 1 W. H. Adams, H. T. Chenoweth Sur., 10 mi. SW Chenowith, elev. 610 ft., Woodbine 2,628 ft., dry, TD 3,400 ft.

Shelby County: M. E. Davis (J. C. Benedum) 1 Pickering Lumber Co., Wm. J. Brittain Sur., 6 mi. E Patroon, elev. 282 ft., Paluxy 4,470 ft., Upper Glen Rose 4,910 ft., James 6,415 ft., dry, TD 7,505 ft.

PERMIAN BASIN

Deep Test in Means Field Is Failure

MIDLAND.—Humble Oil & Refining Co. 88-X Means, Section 9, Block B-35, Public School Land Survey, deep test in the Means field of northeastern Andrews County, is dry at 14,093 ft., in the Ellenburger which was topped at 13,960 ft. Elevation was 3,162 ft. On a 36-minute drill-stem test at 13,962-14,093 ft., 1,980 ft. of salt water with no shows of oil and only a small show of gas was recovered. Stanolind Oil & Gas Co. 1-BB University, Section 17, Block 11, University Lands, southeast offset to the discovery well in the Three-Bar pool of southern Andrews, ran a 2-hour drill-stem test at 8,037-8,110 ft. in the Devonian. Gas came to the surface in 16 minutes and 5,990 ft. of clean oil and gas-cut mud was recovered.

Sinclair Prairie Oil Co. 1 Bedford, Section 10, Block 73, Public School Lands Survey, wildcat 20 miles southwest of Shafter Lake, southwestern Andrews County, ran a 1-hour drill-stem test at 10,062-125 ft. and recovered 25 ft. of drilling mud with no shows of gas, oil or water. It was drilling below 10,207 ft. in lime. In the same area Shell Oil Co., Inc., and The Texas Co. have filed application for permit to drill a 1,867-ft. southeast offset to their 1 Ratliff & Bedford, indicated 4-pay discovery. The proposed 12,000-ft. test will be drilled 1,980 ft. from the north line and 660 ft. from the east line of Section 4, Block 73, Public School Lands Survey. The area has been named the Bedford field.

Ector County: Stanolind 3-Q Scharbauer, Section 12, Block A, Public School Lands Survey, wildcat on the north end of the Goldsmith pool, which failed in the Ellenburger when drilled to 9,155 ft., is being plugged back by stages to 8,100 ft. in the Silurian. This section indicated production on a 2-hour drill-stem test at 7,969-8,011 ft. Gas showed to the surface in 20 minutes with recovery of 295 ft. of heavy oil and gas-cut drilling mud.

Stanolind 1 Williamson, Section 5, Block 45, T-1-N, T&P Survey, wildcat 15 miles northwest of the Goldsmith pool, having found some scattered porosity and oil bleeding in the lower section of the Permian, ran a 1-hour drill-stem test at 7,050-7,110 ft. Recovery was 45 ft. of drilling mud with a slight show of gas and a rainbow show of oil on top. It will be drilled to the Ellenburger. Texas 29 Connell, Section 9, Block B-16, Public School Lands Survey, wildcat 2 miles west of the Penwell field, on a 2-hour drill-stem test at 7,550-7,757 ft. recovered 420 ft. of drilling mud with no shows of oil, gas or water. It was drilling below 7,790 ft. in chert.

The following fields each had two completions this week: Slaughter field, Cochran and Hockley counties; TXL field, Ector County; Mabee field, Martin County; and North Ward-Estes field, Ward and Winkler counties. Means field, Andrews County; Block 31 field, Crane County; Garza field, Garza County, and Todd Deep field, Crockett County, each reported two new locations.

WEST TEXAS SUCCESSFUL WILDCAT

Cochran County: Extension to old oil pool —Texas Gulf Prod. 1 Allie Slaughter, Leag. 113, Potter CSL, 3 mi. W Dean field, elev. 3,791 ft., San Andres 4,180 ft., flowed 361 bbl. day through 2-in. tubing, perf. 5,010-63 ft. San Andres, gravity 31.5°, gas-oil ratio 1,360, TD 5,063 ft.

WEST TEXAS WILDCAT FAILURES

Hockley County: Woodley Petroleum 1 Ellwood, Sec. 26, Blk. A, R. M. Thompson Sur., 1 mi. W Smyer, San Angelo 5,220 ft., Clear Fork 5,760 ft., dry, TD 6,028 ft.

Lynn County: Continental 1 W. H. May, Sec. 10, Blk. 7, EL&RR Sur., 4½ mi. S Wilson, elev. 3,045 ft., dry in Clear Fork, TD 6,840 ft.

Upton County: Seaboard 1 Amacker-Halff, Sec. 37, Blk. D, CCSD&RGNG Sur., 15 mi. NW Rankin, elev. 2,742 ft., Yates 2,450 ft., dry in San Andres, TD 5,100 ft.

Val Verde County: Texas Gas Utility 1 W. T. O. Holman, Sec. 47, Blk. N, GI&SA Sur., 5 mi. SE Comstock, elev. 1,281 ft., dry, TD 490 ft.

SOUTHEASTERN NEW MEXICO

HOBBS.—Forest E. Levers 1-B Levers, 34-16s-29e, a wildcat 6 miles south of the north line and 14 miles west of the east line of Eddy County, logged showings of oil at 2,660-65 ft. in lime and bailed 12 bbl. of oil in 24 hours. It was drilling below

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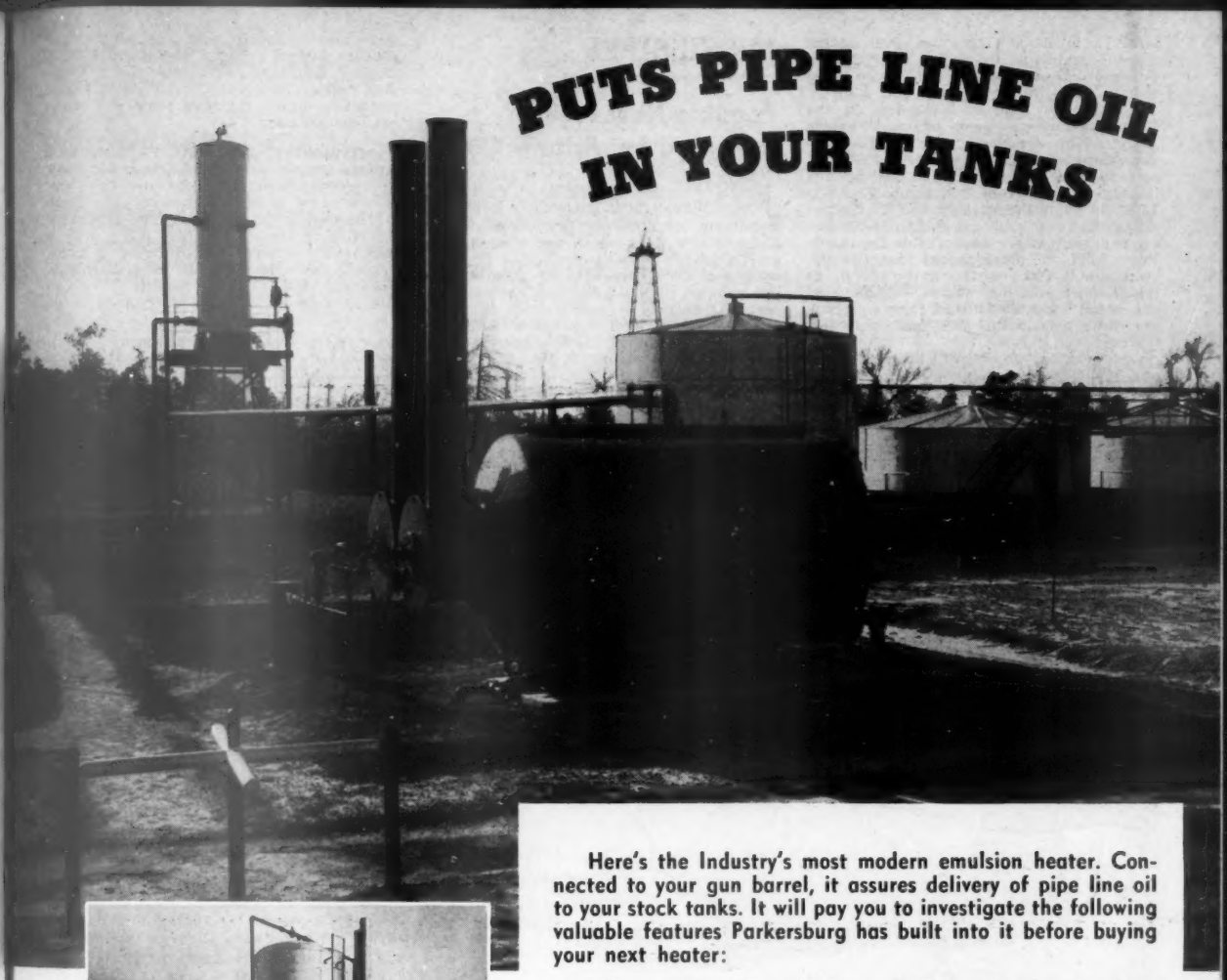

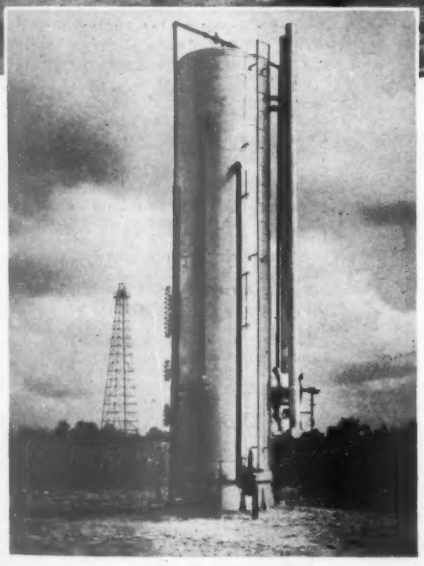

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2,785 ft. in lime. Two miles west of the Russell field in north central Eddy County Sergent & Rutter will drill 1 State. It is 330 ft. from the south line and 2,310 ft. from the east line of 21-20s-28e. In the Grayburg-Jackson pool, of northeastern Eddy, which produces from the San Andres, Grayburg Oil Co. will drill a 6,500-ft. test to the lower Permian. It is 1-A Keeley, 660 ft. from the north line and 1,980 ft. from the east line of 24-17s-29e.

The Texas Co. 2 Lockhart, 18-22s-38e, on the southwest side of the Drinkard-Yeso field in southeastern Lea County, swabbed 40 bbl. of 41-gravity oil in 24 hours after treating with 1,000 and 2,000 gal. of acid at 5,560-5,610 ft. It was preparing to retreat with 5,000 gal. and test further.

Grayburg-Jackson field, Eddy County, and Paddock field, Lea County, each had two completions this week. The Grayburg-Jackson field reported two new locations and Paddock field four.

MISSISSIPPI

Possible New Field Indicated for Adams Co.

JACKSON.—Adams County may have a new Wilcox pool opened by Roeser & Pendleton and Sohio Petroleum Co. 1 Baker-Maier, 68 ft. south and 2,163 ft. east of NW corner of 34-6n-2w, about 10 miles southwest of Cranfield pool. The Wilcox was topped at 4,345 ft., and shows were cored at 4,630-46 ft. and 6,213-47 ft. Drilling is now progressing below 8,670 ft., and will continue to the Massive sand before production testing is done.

Twelve wells were completed this week, including nine oilers, and three dry holes, two of which were wildcat tries. Six new locations have been announced. Four field tries are scheduled, one each for Cranfield in Adams County, Eucutta in Wayne County, East Heidelberg in Jasper County, and Tinsley in Yazoo County. Both Perry and Washington counties have one wildcat location each.

MISSISSIPPI WILDCAT FAILURES

Adams County: Charles H. Osmond 1 Armstrong-Ellislie, 1,129 ft. north and 88° 54′ west of NE corner of fractional Section 31-5n-2w, dry, TD 11,212 ft., Massive sand 11,105 ft.

Jefferson County: Gulf Refining 2 Cato, NW NW NE 30-8n-4e, dry, TD 8,028 ft in salt.

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OHIO, KENTUCKY

Monroe County Has Probable New Oil Pool

COLUMBUS.—Indications of a small oil pool were found adjoining the town of Stafford, Monroe County, in Franklin Township. Isaac Tanner 1 Grace Mallett, Sec. 8, topped the Injun at 1,370 ft. and flowed 65 bbl. with 500,000 cu. ft. gas.

At the Preston Oil Co. 1 H. O. Kamps Consolidation, Lot 9, Granger Township, Medina County, Clinton at 3,542-3,596 ft. was shot after standing for some time and flowed 65 bbl. in 24 hours.

Ashland-Lorain field reported eight new locations and completed nine wells for the week to lead in both locations and completions.

Frank Lyons has staked a deep test in Hanover Township, Columbiana County, on A. B. Wright, Sec. 10. Two previous tests in the Township have proved to be failures.

OHIO SUCCESSFUL WILDCAT

Medina County, Wadsworth Township: H. C. Bishop 1 Rasor & Seiberling, Lot 2, Clinton 3,669-3,702 ft., 200,000 cu. ft. at 3,669-75 ft., shot and shut in at 115,000 cu. ft., TD 3,721 ft.

WESTERN KENTUCKY

OWENSBORO.—Ryan Oil Co. 1 M. J. Greenwell and A. J. Pfeiffer, SW¼ 17-P-20, 2 miles east of Uniontown, Union County, opened a new productive spot with an initial production of 271 bbl. from Cypress sand at 2,342-47 ft., total depth 2,350 ft. It was one of six completions reported during the week in western Kentucky, three oil wells, one gas well and two dry holes.

An important near-completion was Ryan Oil Co. et al 1 Virginia Crafton, SE SW NE 9-O-24, in Henderson County, which made a 2-hour drill-stem test of Cypress sand at 2,037-50 ft., recovering 488 ft. of clean oil and 120 ft. of water. It is 3 miles from other production.

SUCCESSFUL WESTERN KENTUCKY WILDCAT

Union County: Ryan Oil 1 Greenwell & Pfeiffer, SW¼ 17-P-20, 2 mi. E of Uniontown. Cypress sand 2,342-47 ft., TD 2,350 ft. Pumped 271 bbl. of oil in 24 hours. New pool, or an extension to the Uniontown pool.

INDIANA

EVANSVILLE.—The most important completion reported in Indiana during the week was Ryan Oil Co. 1 Fannie G. Putnam, NE NW NW 26-1s-12w, Gibson County wildcat, which started off at 137 bbl. per day from Hardinsburg sand at 1,790-1,801 ft., the total depth. The well is 2½ miles from production in the Mt. Carmel field, which lies mainly in Illinois.

SUCCESSFUL INDIANA WILDCAT

Gibson County: Ryan Oil 1 F. G. Putnam, NE NW NW 26-1s-12w. Hardinsburg sand 1,790-1,801 ft., IP 137 bbl. Two

and one-half miles from nearest production.

ROCKY MOUNTAIN

Important Strike Near Cut Bank Field

DENVER. — Montana, for the second time this month, has scored with an important discovery in a deeper pay in a producing field. The most recent is Carter Oil Co. 1 E. N. Brindley, C NE NE 12-36n-6w, North Cut Bank, 4 miles north of the nearest oil well and 2 miles west of the nearest gas wells in the Cut Bank field, Glacier County. The Madison lime was topped at 3,084 ft. (datum + 700 ft.) total depth is 3,087 ft. On a swabbing test it made 122 bbl. of 37-gravity oil in 21 hours. The Cut Bank sand at 2,882-2,942 ft. carried 350 ft. of water.

The discovery is of more significance than an extension of the productive area of the field. The Cut Bank field is approximately 30 miles long and 12 miles wide and general practice has been to stop in the top of the Ellis formation, which overlies the Madison. There are large areas where the Madison has never been tested. The Carter discovery opens vast possibilities on the noses throughout the field.

East Lance Creek extended. — Continental Oil Co. 1-B Leach, NW NW SE 20-36n-64w, East Lance Creek, Niobrara County, not only extended the productive area ⅝ mile to the north, but proved to be the best well so far completed in the field. It flowed 144 bbl. of oil and 48 bbl. of drilling mud in the first 8 hours from the Dakota at a total depth of 3,945 ft.

Rangely field.—The Rangely field, western Colorado, is now running over 8,000 bbl. of oil per day, and has 23 active drilling wells. An engineering committee has been organized, with Hugh A. Stewart, of the Texas Co., as chairman, and J. J. Zorichak, formerly with the Petroleum Administration for War, as field engineer.

Another test for Greasewood.—The Colorado Unit Corp., headed by R. S. Shannon, has leased a large block in Weld County, Colorado, and is preparing to drill a deep test about a mile northwest of the old Greasewood field, probably in 11-6n-61w.

Discovery at Zimmerman Butte.—A new field at the southern end of the Big Horn basin appears imminent in Pacific Western Oil Corp. 1 P. C., NW SW SW 36-44n-93w, on the Zimmerman Butte structure, Hot Springs County, Wyoming. The Embar was topped at 4,328 ft. and drilled to 4,348 ft. A drill-stem test at 4,320-48 ft., open 16 minutes, recovered 600 ft. of oil.

New operations.—Eight new operations were reported, two in Colorado, one in Wyoming, three in Montana, and two in northwest New Mexico. Two are wildcats, one outpost at Fulcher Basin, San Juan County, New Mexico, Southern Union Production Co. 1 Rice, NW SE SE 20-30n-12w, the other is Gled Oil Co. 1 Campbell, SE NW NW 3-29s-69w, Ojo-Oakview district, Huerfano County, Colorado.

COLORADO WILDCAT FAILURE

Maudlin Gulch, Moffat County: Frontier Refining 1 Unit, NE NW NW 35-4n-95w, TD 6,350 ft., in Morrison sand, top 6,160 ft., top Dakota 5,663 ft., show of oil with water in Morrison, temp. abd.

WYOMING SUCCESSFUL WILDCAT

East Lance Creek, Niobrara County: Continental 1-B Leach, NW NW SE 20-36n-64w, TD 3,945 ft., top Muddy 3,705 ft., top Dakota 3,890 ft., swabbed 144 bbl. oil and 48 bbl. drilling mud in 8 hours, extension ⅝ mile north.

WYOMING WILDCAT FAILURES

McGowan, Fremont County: Carter 1 Shoshone-Arapahoe, NE SW 24-1s-1e, TD 4,777 ft., top Tensleep 4,755 ft., dry.

Lucerne, Hot Springs County: Pacific Western Oil Corp. 1 Weadick, NE SW NE 22-43n-94w, TD 2,448 ft., water in Tensleep, dry.

MONTANA SUCCESSFUL WILDCATS

Cat Creek, Petroleum County: Schrock 1 Fifer, NW NW NW 21-15n-30e, TD 1,394 ft., top of Ellis 1,392 ft., flowed 11 bbl. per hour 51.9-gravity from Ellis sand, top first Cat Creek 766 ft., second Cat Creek 981 ft., third Cat Creek 1,093 ft., ground elevation 2,522 ft. Discovery in deeper sand.

North Cut Bank, Glacier County: Carter 1 E. N. Brindley, NE NE 12-36n-6w, TD 3,087 ft., top Madison 3,084 ft., swabbed 122 bbl. oil in 21 hours from Madison, 37-gravity; elevation 3,784 ft., top Kootenai 2,825 ft., upper Sunburst 2,930-42 ft., lower Sunburst 2,855-65 ft., Cut Bank 2,882-2,942 ft.

NORTHWEST NEW MEXICO SUCCESSFUL WILDCAT

Fulcher Basin, San Juan County: Maddox, Seivert 1 Hargis, NE SW NE 33-30n-12w, TD 1,808 ft., 7-in. 1,685 ft., 1,250,000 cu. ft. gas from Picture Cliff sand, northwest extension.

NORTHWEST NEW MEXICO WILDCAT FAILURES

Kutz Canyon, San Juan County: Southern Union Prod. Co. 2 Cain, CEL NW NW 15-28n-10w, TD 2,190 ft., dry in Farmington sand, show only in Picture Cliff, dry.

Walker, McKinley County: Plymouth Oil 1 Santa Fe Railroad, SW NW 13-15n-10w, TD 6,210 ft., in granite, Pennsylvania not in place, no shows, dry.

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CANADIAN FIELDS

Large Well Completed In Steveville Field

CHATHAM.—In the Princess section of the Steveville field, in eastern Alberta, National-Empire 1, LSD 10, 34-19-12w4, south of previous production, is finishing what looks like a large producer in the Sunburst sand. Finished at 3,288 ft., well into the formation, an initial test indicated 60 bbl. an hour at 1,615 ft., bottom-hole pressure with well beaned down to ¼-in. In a 60-minute test the well filled the drill pipe in 44 minutes and subsequently flowed 16 bbl. of 26 to 28-gravity crude. Separators and tanks have been installed and definite production test is in progress. Potentially the well is the largest producer in Alberta outside Turner Valley, but will likely be held to 250 bbl. while the formation is studied.

In the same area, Empire-Pacific 2, LSD 16, 22-19-12w4, previously finished as a large gasser bottoming at 4,300 ft., is making 22.4 bbl. daily through a ⅜-in. valve, with indications that oil is increasing. Two tests in the Steveville field are drilling, one rigging pump and one is starting.

Conrad.—In the Conrad field, southern Alberta, Conrad-Province 75-33-B, LSD 12, 33-5-15w4, TD 3,077 ft. has been put on the pump with initial production 98 bbl. in 20 hours. Conrad-Province 13-32-B, LSD 8, 32-5-15w4, finished a few feet in the Ellis at 3,096 ft., oil rose 975 ft. in the 4½-in. pipe in 1 hour, indicating 80 to 100 bbl.

Vale Dome.—On the Vale Dome structure in the Wainwright Buffalo Park area, Central Alberta, Martin 1, LSD 2, 17-42-6w4, TD 3,000 ft., which failed to get oil, is testing an upper formation, a horizon at 2,467 ft., showing 1,000,000 cu. ft. gas. Tests are continuing.

Turner Valley.—In Turner Valley, Okalta Oils 22, LSD 8, 1-20-3w5, in the north-central area, finished in the brown sand of the Dalhousie formation at 4,508 ft. and is testing. This well was drilled to test the shallow crude horizon above the Madison lime. Two wells are testing and one drilling in the lime, eight others drilling and two starting.

Jumping Pound.—In the foothills west of Calgary, Shell 10-14-J, LSD 10, 14-25-5w5, is in Kootenay formation below 10,520 ft. with the Madison limestone producing horizon expected around 11,000 ft.

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CALIFORNIA

Kern County Discovery Flowing 960 Bbl. Per Day

LOS ANGELES.—Independent Exploration Co. has discovered California's newest oil field in the Cymric area of Kern County but the real significance that attaches to this completion lies in the fact that it may change the geologic aspect of the west side of the San Joaquin Valley at least as far as Kern County is concerned. Independent Exploration, drilling on a lease from Oceanic Oil Co., completed the discovery well, located in Section 22-29s-21e, flowing at a daily rate of 960 bbl. per day from the Belridge 64 sand with bottom of the hole at 4,700 ft. The bit was still in the pay when drilling operations were concluded and hence the full amount of sand will not be known until a second well is drilled. The status of the discovery well changed almost over night because when the Phacoides sand was found barren at 4,213 ft. and the Carneros sand of Miocene age was missing, the outlook did not look any too promising. With the coring of the Belridge 64 sand, however, there was no question that an excellent flowing well would be completed. This is the most southerly well on the west side of the Valley in which the Belridge 64 sand has been found and available evidence indicates the probability the same sand may be found highly productive in or around the South Belridge field. The Cymric area has been in the limelight for the past few years due to the development of production in the tar sands of this region and during the current year to date, Union Oil Co. proved up the existence of a deeper productive sand in the original Cymric field. Union's discovery is located about 1½ miles southeast of the new discovery of Independent Exploration Co.

Kern Oil Co. appears to have the making of a splendid flowing well in the Race Track field as the company's 37-34 on fee-owned acreage in Section 34-29s-29e, flowed at a daily rate of 2,400 bbl. of clean oil with a considerable volume of gas. On a formation test at 4,590-4,635 ft. the well flowed 10,000,000 cu. ft. of gas and at 4,630-4,652 ft. the well flowed clean oil and gas through a ¼-in. bean. Superior Oil Co. has recompleted its 36-35 Anderson at Paloma after landing liner and this well which flowed at a 1,552-bbl. daily rate on an open-hole test ranks as one of the best completions at Paloma to date. Production will be beaned down but the well's initial indicates the completion of an excellent flowing well.

Another week has passed in which the number of new locations, 29, has fallen far below the completion rate, 42, and if this keeps up we may expect a substantial decline in drilling operations. Standard has resumed drilling operations in its Leffingwell wildcat between West Coyote and Santa Fe Springs and Ohio Oil Co. is still working on its Gardena wildcat which has developed a troublesome water condition that has defied correction. It is generally conceded Ohio has found a new field at Gardena although it may take another well to prove it.

CALIFORNIA SUCCESSFUL WILDCAT

Kern County, North Cymric: Independent Exploration Co. 1 Oceanic, 22-29s-21e, flowed 960 bbl. daily rate, 37.5-gravity, 5 per cent cut but cleaning up, 2,000,000 cu. ft. gas, 20/64-in. bean, pressures 740/580 lb., TD 4,700 ft., perforated 4,650-4,700 ft., top Phacoides sand 4,213 ft., top Belridge 64 sand 4,657 ft., on electric log the Belridge sand kicked off page.

CALIFORNIA WILDCAT FAILURES

Kern County, Belridge: Belridge Oil Co. 113-7-fee, 7-28s-21e, bottomed in gray sand, first oil stained sand 980 ft., first oil sand 1,030 ft., not tested, TD 1,520 ft.

Kettleman South Dome: Los Nietos 41 South Dome, 13-25s-19e, bottomed in probable Cretaceous shale, drilling break 7,350 ft. probable transition zone, top Tembior 7,362 ft., oil stained sand 7,464-97 ft., no important showings, TD 8,550 ft.

Los Angeles County, Las Llajas: Standard 2-1-A Brady, 13-3n-17w, bottomed in very hard gray sand, no important showings logged from top to bottom, TD 9,576 ft.

Seal Beach-Long Beach: Shell 1 Bryant Ranch 34-4s-12w, bottomed in barren gray sand, only minor showings logged, running very low structurally, TD 10,280 ft.

Santa Barbara County, Capitan: Hamilton & Sherman 1 Rutherford, 1-4n-31w, bottomed in hard gray sand, Vaqueros sand of Miocene age was barren, TD 2,275 ft.

Los Alamos: Whittier & Associates 3 Buell, 15-7n-32w, bottomed in gray shale, only minor showings logged, TD 2,834 ft.

Solano County, Rio Vista: Peter Cook 1 upper unit, 21-5n-3e, bottomed in barren gray sand, no important gas showings logged, TD 5,000 ft.

Ventura County, Long Canyon: Shell 1 McBean, 32-3n-20w, bottomed in barren gray sand, only minor showings logged, TD 10,549 ft.

LA.-ARK.

Oil Discovery Completed In Claiborne Parish

SHREVEPORT.—Opening of a new pool in Claiborne Parish was indicated with the formal completion of Hunt Oil Co. 1 Birdsong, 630 ft. north and 2,033 ft. west of the SE corner of 15-23n-7w, about three miles east of the Haynesville pool. The well produced an initial of 112 bbl. from the lower Sligo at 5,172-81 ft.

In the Arkansas fields, Robert C. Wallingsford 1 Union Sawmill, SE NW NW 13-18s-13w, a wildcat in Union County, improved from 5 bbl. per day to 15 bbl. per day after treatment with 500 gallons of acid. There were only four completions in Arkansas this week, including an oil well for Fouke pool, a dry hole for Mt. Holly pool, and two dry wildcats.

In North Louisiana, nine completions were made—four oil wells, including the one successful wildcat, three gas wells and two dry holes, one of which was a wildcat.

NORTH LOUISIANA SUCCESSFUL WILDCAT

Claiborne Parish: New oil pool—Hunt Oil 1 Birdsong, 630 ft. north and 2,033 ft. west of SE corner of 15-23n-7w, 112 bbl. from lower Sligo at 5,172-81 ft., TD 5,181 ft.

NORTH LOUISIANA WILDCAT FAILURE

Claiborne Parish: Delta Drilling and M. J. Houston 1 Gladney, 1,980 ft. north and 1,974 ft. east of SW corner of 10-21n-8w, dry, TD 7,515 ft.

ARKANSAS WILDCAT FAILURES

Miller County: Barnsdall 1 Nichols et al, NE NW 20-18s-28w, dry, TD 8,457 ft.

Ouachita County: Brizzolora & Carnes 1 Dodson Bros., 100 ft. north and 240 ft. west of SE corner of SW NW 35-15s-19w, dry, TD 3,201 ft.

OKLAHOMA

Deep Rock Opens Pool in Eastern Noble County

SEVERAL miles from any other production, Deep Rock Oil Corp. 1 Emma Arrendell, SW NW SW 12-23n-1e, Noble County, Oklahoma, opened a pool in the Wilcox sand. Top of the sand was found at 4,584 ft. (corrected measurement). Casing was set at 4,590 ft., first oil at 4,593 ft. and total depth 4,600 ft. The well flowed naturally making 230 bbl. in 8 hours, and the next day 230 bbl. in 11 hours. It is on a large block with a numerous ownership, Deep Rock having a good share of the leases in eight secions in 23n-1e and 23n-2e, and Phillips, Gulf and Texas companies having close-in acreage. The well is about 1½ miles north and then 1 mile east of the town of Red Rock.

The northeast Hobart pool, in Kiowa County, was extended by F. L. Rockstool 1 Laufer, NE NE NE 9-7n-17w. Casing was perforated at 1,707-20 ft. and the well flowed 16 bbl. of 37.5-gravity oil in 2 hours with gas estimated at 1,000,000 cu. ft. per day.

Pay in the West Edmond field in Oklahoma County was extended southerly by Deep Rock Oil Corp. 1 Tolbert, C NE NW 4-12n-4w, which flowed 346 bbl. of oil in 14 hours from the Bois D'Arc section at 7,070-7,110 ft. After it was acidized the well flowed 372 bbl. in 3 hours. No. 2 Tolbert was close to the completion stage.

Over in Beckham County, in the far western part of the state, Pure Oil Co. 1 Hudgins, C NE NW NW 26-9n-26w, a wildcat, made a 1-hour test at 3,812-80 ft., recovering 200 ft. of mud and a showing of dead oil. Granite wash was topped at 4,210 ft. and the well was drilling at 4,507 ft.

Shell Petroleum Corp. which abandoned some time ago its 1 Wantland, C NE NE 6-9n-2w in Cleveland County, has released some depth figures. Bartlesville sand was absent; Hunton lime was topped at 6,957 ft., and Sylvan shale at 7,064 ft. and total depth was 7,121 ft.

Carter Oil Co. 1 Mottinger, C NW NW 5-6n-3w, McClain County, with second Wilcox sand topped at 10,833 ft., total depth 10,844 ft., will soon be given a drill-stem test. Same company's 1 Hawkins, C NE NE 34-6n-3w, had Viola lime at 8,736-46 ft. and was drilling at 8,888 ft. Formations in this well are running much higher than in other wildcats in the Washington area.

OKLAHOMA SUCCESSFUL WILDCATS

Jackson County: New oil pool—Texas 1 Holt, NE NE SE 8-1n-19w, pumped 14 bbl. of 40.8-gravity oil from granite wash at 1,419-33 ft., TD 2,976 ft., PB 1,490 ft., granite wash 1,437 ft., Arbuckle 2,851 ft.

Kay County: Extension to Tonkawa—Continental 1 Mansfield, SE NE NE 25-25n-2w, pumped 53 bbl. from 4,390-4,401 ft., TD 4,401 ft., Layton 3,370 ft., Oswego 3,858 ft., Skinner 4,117 ft., May 4,317 ft.

OKLAHOMA WILDCAT FAILURES

Garvin County: F. F. Pennington 1 Murr, NW SW NE 24-4n-3e, dry, TD 2,642 ft.

Lincoln County: Dickson & Sunray 1 Potter, SE SE NE 13-14n-4e, dry, TD 3,745 ft., Prue 3,651 ft.

Stephens & McBride 1 Ford, SE SE NE 6-13n-3e, dry, TD 5,460 ft., second Wilcox 5,438 ft.

Payne County: Bradley et al 1 Berg, SE SE SE 2-19n-6e, dry, TD 3,040 ft., Bartlesville 3,017 ft.

MALONEY TANK ANNOUNCES SEVERAL CHANGES

S. P. Wallace, formerly president of Crawford Tank and Supply Co., Dallas, on November 1 became general sales manager of Maloney Tank Mfg. Co., with headquarters in Dallas. **L. Glenn Rader,** formerly Crawford director and district manager at Houston, is Maloney division manager at Houston. **Arthur J. De laHoussaye,** formerly Crawford representative in southern Louisiana, is district manager for Maloney in New Orleans. **W. B. Brawner,** representative at Corpus Christi for Crawford, is Maloney district manager for southwest Texas, keeping Corpus Christi headquarters.

These four men were veterans of the Parkersburg Rig and Reel organization before joining the Crawford Tank and Supply Co. 2 years ago.

Further changes as of November 1 in the Maloney Tank Mfg. Co. organization are announced as follows:

E. C. Kopp, of Hanlon-Waters, Inc., becomes division manager for Maloney for North and West Texas, with headquarters at Fort Worth. **Dugan Glakeney,** Hanlon-Waters, Inc., representative at Odessa, goes with Maloney at same place.

R. H. Guthrie, H. H. Guthrie, and **Frank Gurtler** remain in the West Texas Maloney headquarters at Odessa.

D. E. Amy, of Houma, La., transfers from Crawford Tank and Supply Co. to Maloney. **C. E. Henderson** similarly transfers from Crawford to Maloney at Lake Charles, La.

C. L. Pirtle, J. B. Graham, Miss Alice Wolf, all of Houston, transfer from Crawford Tank to Maloney.

Carl Kinser and **Lester Moore,** Maloney representatives for several years at Corpus Christi, remain in their same capacities. **Carl Folkner,** district manager for Maloney at Artesia, N. M., is promoted to division manager in charge of New Mexico, Colorado, and Wyoming.

F. L. Bruckner, formerly of Parkersburg and Crawford, joins the sales department of Maloney in Tulsa.

T. J. Costello continues with Maloney as sales representative in Oklahoma, and **Guy Stevenson** continues as field man for Maloney at Artesia, N. M.

De laHOUSSAYE

W. B. BRAWNER

S. P. WALLACE

L. GLENN RADER

E. C. KOPP

CARL FOLKNER

KANSAS

Merten Pool Extended To the Northeast

PHIL-HAN Oil Co. 1 Mauler, SW SW SW 36-18-15w, ¾ mile northeast of the Merten pool of Barton County, looks promising. After drilling to a total depth of 3,567 ft., the hole filled with oil and operators are preparing to test. The oil is from the Basal sand at 3,564-67 ft. Reagan was topped at 3,543 ft., and 5-in. pipe was set at 3,545 ft.

Anderson-Prichard Oil Co. and Mercury Drilling Co. 1 Seyfert, SE SE SE 21-16-11w, on the east edge of the Kraft-Prusa pool in Barton County, is preparing to acidize. After drilling pay from 3,336 ft. to 3,343 ft., the well swabbed 55 bbl. of oil per hour naturally. The well registered a draw down potential of 2,514 bbl. per day, and will be acidized before completing testing. Arbuckle was topped at —1,413 ft., making this one of the highest wells in the field.

Completions this week numbered 42, including 17 oilers, 9 gas wells, and 16 dry holes. Eight dry wildcats were included in the completions, and formal completion was made of the Rooks County discovery, Phil-Han 1 McClellan, NW NW SW 9-9-19w.

KANSAS SUCCESSFUL WILDCAT

Rooks County: New oil pool—Phil Han 1 McClellan, NW NW SW 9-9-19w, physical potential 185 bbl. from Lansing at 3,343-48 ft., TD 3,529 ft., Kansas City 3,222 ft., Arbuckle 3,519 ft.

KANSAS WILDCAT FAILURES

Barton County: C. E. Ash 1 Moses, NE NE SW 35-17-13w, dry, TD 3,358 ft., Arbuckle 3,342 ft.

Decatur County: Continental 35 Strat, NE SW SW 26-5-27w, dry, TD 4,076 ft., Arbuckle 4,070 ft.

Ellis County: Comanche et al 1 Simpson, NE NW NW 10-11-17w, dry, TD 3,421 ft., Arbuckle 3,384 ft.

Russell County: Beardmore Drilling et al 1 Witner, NW NW SE 3-14-12w, dry, TD 3,395 ft., Arbuckle 3,368 ft.

Sedgwick County: Beech Aircraft 1 Goodin, NE NW NW 34-28-2e, dry, TD 3,365 ft., Simpson 3,314 ft.

Stafford County: Ed Adair et al 1 Roberts, SE SE SE 14-21-12w, dry, TD 3,618 ft., Arbuckle 3,600 ft.

Magnolia 1 Schlochtermeyer, NE NE NW 7-21-11w, dry, TD 3,498 ft., Arbuckle 3,472 ft.

Trego County: Ohio Oil 1 Silkman, NE SW 31-11-22w, dry, TD 4,203 ft., Arbuckle 4,078 ft.

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Among the Drilling Contractors

Helmerich & Payne, Inc., Tulsa, has opened a land and drilling department office in Midland, Tex. Oliver G. Morgan, recently discharged from the Navy, will be in charge.

Trio Drilling Co. has the contract for C. W. Collin 1 Whittiker, NE SE SW 20-2s-5w, a wildcat in Washtenaw County, Michigan.

Smith Brothers Drilling Co. has the contract for Sam Viersen and Renco Oil Co. 1 Beresford, NE NE SW 1-14n-4w, a wildcat 2 miles east of West Edmond field in Oklahoma County, Oklahoma.

Cook Drilling Co. is clearing location for Skelly Oil Co. 1 Lightsey, SW SW NW 18-1n-13e, in the East Heidelberg field of Jasper County, Mississippi.

Hays Drilling Co., Mt. Carmel, Ill., is the contractor for Ryan Oil Co. 1 Broster, SW SW SW 26-2s-14w, Wabash County, Illinois.

Delta Drilling Co., Evansville, Ind., will drill the Iley B. Browning 6 Springer, 9-N-23, in Webster County, Kentucky.

Crow Drilling Co. will drill the Magnolia Petroleum Co. 1 McGill heirs, 660 ft. north and 330 ft. west of SE corner of NE 13-9n-9w, in the Eucutta field of Wayne County, Mississippi.

Hays Drilling Co., Mt. Carmel, Ill., has the contract for Ryan Oil Co. 1 Crafton, SE SW NE 9-O-24, a wildcat in Henderson County, Kentucky.

Conway Drilling Co. is rigging up to drill the Seaboard Oil Co. 1 McConnico, a reinstated wildcat location 467 ft. north and 467 ft. east of the SW corner of NW 32-12n-10e, in Wilcox County, Alabama.

George & Wrather, Mt. Carmel, Ill., will drill the Deep Vein Coal Co. 1 Shalem, NW NW SW 6-2s-11w, in Gibson County, Indiana.

Lyons & Prentiss has the contract for T. F. Hodge et al 1 Malone, 73-7n-1w, in the Cranfield pool of Adams County, Mississippi.

Exploration Drilling Co. has the contract for National Associated Petroleum Co. 3 Rubenacker, NW SE NE 15-5s-7e, in Hamilton County, Illinois.

Fain-Porter Drilling Co. has the contract for Renco Oil Co. and Superior Oil Co. of California 1 Johnson, NW SW SW 12-15n-4w, a 6,800-ft. test in the West Navina area of Logan County, Oklahoma.

C. E. Brehm is the contractor for Central Pipe Line Co. 1 Metcalf, W/2 NE NE 5-2s-9e, in Wayne County, Illinois.

Rine Drilling Co., Wichita, Kan., is drilling below 4,850 ft. on the Atlantic Refining Co. 1 Schmidt, SE SE SW 25-24n-5w, in Garfield County, Oklahoma.

Voorhees Drilling Co. is the contractor for Neil Wagenaar 1 Kyncl, NE NE SE 35-16n-18w, a wildcat in Oceana County, Michigan.

Hunter and Percival are contractors for Ashland Oil & Refining Co. 3 Thompson heirs, 7-O-21, in the Waverly North pool of Union County, Kentucky.

Penrod Drilling Co. will drill the Hunt Oil Co. 3 Smith County Oil Co.,

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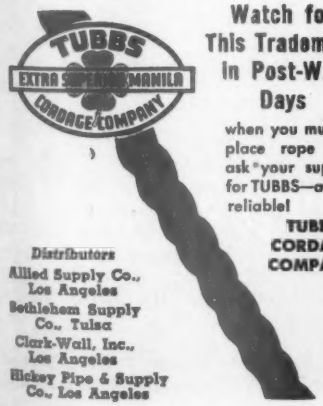

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SW SW 4-2n-8e, a wildcat in Smith County, Mississippi.

Goodpasture Drilling Co. has the contract for Sohio Petroleum Co. 1 Richardson, NE NE SE 19-24-11w, a wildcat in Stafford County, Kansas.

Columbia Oil & Gas Co. will drill the Sohio Petroleum Co. 1 Vorres, SW NE NE 6-13n-13w, a wildcat in Newaygo County, Michigan.

O. D. Vickers will drill the F. H. Rhodes and P. Maier 2 Douthitt, SE NW SW 30-7s-7w, in Spencer County, Indiana.

Fisher-McCall Oil & Gas Co., Inc., will drill the James J. McGerry 1 Gent, SW SE NE 21-1s-15w, in Van Buren County, Michigan.

Valley Oil Operators of Calgary have completed Mercury-Mill City 1 test in South Turner Valley, which is now testing production.

CALENDAR

November

Society of Exploration Geophysicists, Pacific Coast District, Ahmassador Hotel, Los Angeles, November 7.

Pacific Section, American Association of Petroleum Geologists, annual fall meeting, Ambassador Hotel, Los Angeles, November 8-9.

FPC regional hearing in natural-gas investigation, Postoffice Building, New Orleans, November 12.

American Petroleum Institute, annual meeting, Stevens Hotel, Chicago, November 12-15.

Independent Natural Gas Association of America, annual membership meeting Dallas, November 26.

December

FPC regional hearing in natural-gas investigation, Baker Hotel, Dallas, December 10.

Michigan Oil and Gas Association, annual meeting, Mt. Pleasant, December 3.

Interstate Oil Compact Commission, Wichita, Kans., December 13-15.

(1946)

February

American Welding Society, national meeting, Hotel Cleveland, Cleveland, February 4-7.

Iron and Steel and Institute of Metals divisions, American Institute of Mining and Metallurgical Engineers, national meeting, Statler Hotel, Cleveland, February 4-8.

American Society for Metals, annual convention (postponed from 1945), Statler Hotel, Cleveland, February 4-8.

Exposition of Chemical Industries, twentieth exposition, Grand Central Palace, New York, February 25-March 2.

April

American Association of Petroleum Geologists, annual meeting, Stevens Hotel, Chicago, April 2-4.

Natural Gasoline Association of America, annual convention, Baker Hotel, Dallas, April 17-19.

May

National Association of Corrosion Engineers, annual meeting, President Hotel, Kansas City, Mo., May 7-9.

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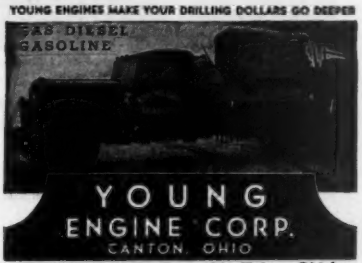

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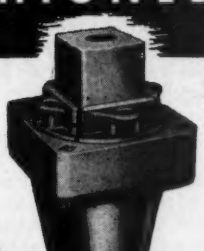

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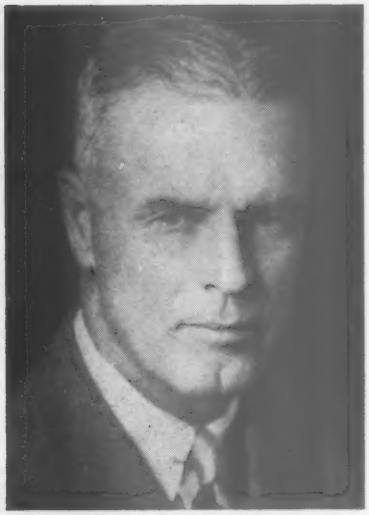

New Vice President Of Union Began As Laborer

R. D. GIBBS, newly named vice president of Union Oil Co. of California, entered the company's service 27 years ago as a laborer in construction of the Los Angeles refinery. Upon completion of the plant he was put in the manufacturing department as a treater, later becoming a machinist helper and an absorption-plant operator.

In 1923 Gibbs was transferred to the research department as a junior engineer, operating a pilot absorption plant at Signal Hill. When the commercial absorption plant was built at Rosecrans, he helped start it up and remained as foreman. Four years later he was moved to the head office as assistant manager of gas operations, taking over the department as manager in 1934.

When the gas and field departments were combined in 1941 Gibbs was selected to head them as manager of field operations. In July of last year, he was appointed assistant to the executive vice president, a position he held until his latest promotion.

Reporting to Gibbs in his new post are the marine, pipe-line and communications, automotive and traffic departments. He is also responsible for crude-oil purchases, supply of petroleum products, and crude-oil and product exchanges.

Russell V. Myer, formerly superintendent of war production in the testing laboratories of American Gas Association, New York, has been named chief engineer in the newly established testing department. **Ralph E. Cramer,** who was assistant chief engineer in the old setup, has been appointed chief engineer of the newly created inspection department.

L. H. Chatham, with The Atlantic Refining Co. at San Angelo and Midland, Tex., for 6 years before entering the Army in 1942, has returned to duty with Atlantic in Louisiana. He is in the geophysical division, working on Lake Ponchartrain north of New Orleans.

F. M. PERRY

Frank M. Perry, who was on special assignment in the New York office of Cities Service Oil Co., has been named manager of the natural gasoline and chemical division. He succeeds **Harry A. Ells,** who joined United Carbon Co. in Charleston, W. Va. Perry's first job after leaving Mississippi A. & M. College, where he majored in electrical and mechanical engineering, was with Toledo Edison Co., a Cities Service power and light subsidiary, as a junior engineer. For the past 18 years, until last July, he was superintendent of General Atlas Carbon Co., Pampa, Tex.

Clyde Barton, Kermit, Tex., has been named Texas agent for Wood River Oil & Refining Co., Wichita, Kans., which is planning to establish an operating department in West Texas.

Col. Freeman W. Burford, who was an independent oil operator in Texas before entering the Army, has been given the Legion of Honor and the Croix de Guerre with Palm by the French Government. The honors were conferred in recognition of Col. Burford's petroleum activities with the U. S. Army during the war. He is now attached to the general staff corps as chief petroleum officer of the European theater. He expects to return to civilian life early in 1946.

M. G. Domsitz, who was senior engineer for Schlumberger Well Surveying Corp. at Corpus Christi from June 1936 until he entered war service in July 1942, returned to that organization November 1. During his absence from Schlumberger he was engaged in research and development work on the VT bomb and rocket fuses at the National Bureau of Standards, Washington.

George Galloway, formerly senior geologist in the Tulsa office of Stanolind Oil & Gas Co., has been transferred to Oklahoma City, as district geologist. He succeeds **Roy McAnninch,** who resigned to enter consultant work.

Stanley T. Crossland, formerly on the staff of Reconstruction Finance Corp., has been named comptroller of Ethyl Corp.

W. R. Harshbarger, of The Texas Co., was reelected oil and gas commissioner for District 5 of the California Division of Oil and Gas for a 3-year term. **Chester Gibbs,** of Standard Oil Co. of California, was reelected to a 2-year term.

W. B. DUNCAN

W. B. Duncan has been appointed general superintendent in charge of drilling and oil and gas production for Houston Oil Co. of Texas, replacing **C. L. Butchee,** who resigned to enter private business. Duncan has served the company in various capacities, including 2½ years in the Hull-Daisetta field, Texas; 1½ years in Camden, Ark.; 20 years in Oklahoma as district superintendent, and 1 year in Shreveport as special agent. His office will be in Houston.

Chester A. Rouse, Fred L. Rouse, Antonio A. Cunha, Jack E. Harring-

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ton, John E. Schmidt, John H. Hartman, Jonathan B. Hughes, Milton G. Kerr, Harry B. Kueny and **Gust G. Anderson** were honor guests at a dinner given in Los Angeles, and each received a gold watch marking 35 years' service with Union Oil Co. of California. Three other honor guests were **Alfred C. Powell** and **Charles L. Tostevin,** each with 40 years of service, and **John E. Reed,** 41.

Reid B. Gray has been appointed director of Reynolds Research Institute, subsidiary of Reynolds Metal Co. Gray succeeds **Dr. Warren J. Mead,** who resigned to devote full attention to his duties as head of the geology department of Massachusetts Institute of Technology.

G. D. HAYES

Lt. Col. George D. Hayes, oil operator of Jackson, Miss., and El Dorado, Ark., and now commanding officer of the Nineteenth Army Air Force base unit at Camp Myles Standish, Massachusetts, started his 100-day terminal leave October 20, after 41 months of service, during which he rose from the rank of captain. As a partner in the firm Short & Hayes, who brought in a new producing horizon in the Rainbow field of Union County, Arkansas, in 1934, Colonel Hayes plans to return to Jackson, where he and his partner, **Robert Short,** reside.

Russell H. Sanborn, for several years with Shell Oil Co., Inc., has been appointed research engineer for Bell Oil & Refining Co., Los Angeles. Bell recently started a specialties department, which will manufacture roofing materials, asphalt-base paint, floor tile and asphalt adhesives.

Capt. R. W. Goff has returned to Houston Oil Co. of Texas from active service with the Third Army and is now a scout in the Upper Texas Gulf Coast district. He takes the place of **R. E. Blewster,** who was transferred to the land department in the Houston district.

Henry R. Dabney, J. H. Fiske, and **H. G. Spengler** have organized S. D. Oil Co. and have started on a core-hole program in the Pyramid Hills district of Kings County, California.

Dewitt Carr, back in Midland, Tex., after serving with the Fifteenth Army Air Force in Europe, has resumed his prewar job as scout for Forest Development Corp.

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NOW BACK IN FULL PRODUCTION after two years' "layoff" because of war work, these oil-proof, wear-resistant, plastic rings hydraulically pressed on all sizes of tubing collars prevent the collar-to-tubing contact that causes many expensive "wet jobs" in pumping wells.

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Equipment Men in News

Design Engineering Co., 207 Midco Building, Tulsa, has been formed by **M. W. Frack**, owner and manager. This company will engage in general mechanical engineering and consulting practice, offering specialized service in design and construction of truck-mounted equipment, patent engineering, industrial product design, and engineering or research programs for small shops or companies. Frack is well known in the oil industry, having formerly served with Tulsa Boiler & Machinery Co. and Dowell Incorporated. Associate engineers affiliated with this company are **R. A. Ferguson, M. L. Birkett,** and **Miss Mildred Kelley.**

The Heil Co., Milwaukee, Wis., announces the appointment of **Edward Fellows** as assistant sales manager of the Tank Division including petroleum transports and stainless-steel milk-storage tanks and "trailerized" transports.

A. L. Gaut has been appointed service engineer in South Texas for Sterling Packing & Gasket Co., with headquarters in Corpus Christi, which office has recently been established. **Tom Ash,** service engineer, has been transferred from Dallas, Tex., to Tulsa, to serve the industry of the entire state.

H. F. Kneen has been named vice president in charge of manufacturing and **G. G. Landis,** vice president in charge of engineering for The Lincoln Electric Co., Cleveland, Ohio.

A new company has been organized in Buenos Aires, Argentina, by name of T.I.P.S.A. (Técnica Industrial Petrolera, Sociedad Anónima). The organizers are **Mario L. Villa,** president, and **Enrique Cánepa,** vice president. Other technical collaborators are **Martín Aranguren** and **Mario Cuetó,** civil engineers with many years of experience with refinery problems.

The Cummins Engine Co., Inc., has reorganized its sales department, creating two new sales divisions. Under the new plan, sales activities will be divided into two major fields—direct sales through dealers, and sales to manufacturers who power their equipment with Cummins diesels. **Norman E. Palmer** becomes general sales manager to work directly with **Paris E. Leisinger,** vice president in charge of distribution. **J. D. Allen** becomes sales manager of dealer organizations, and **Fred W. Sparks** becomes sales manager of manufacturing accounts.

Invention and development by Universal Oil Products Co., Chicago, Ill., of a catalytic-cracking unit of radically new design is announced by **Dr. Gustav Egloff.** This new cat. cracker can be installed at low cost and fitted to small-scale refining operations. It makes practical for the small refiner the use of the most modern procedures and technique of catalytic cracking to produce superior quality aviation and motor gasoline.

L. R. Austin, of Billings, Mont., has been appointed distributor for Wickwire Spencer wire rope in Montana, Wyoming, and Idaho, according to an announcement by **A. S. Rairden,** sales manager, wire rope division.

Joseph Edie has been named branch manager of Jessop Steel Co. at Indianapolis, Ind., according to an announcement by **T. W. Pennington,** vice president in charge of sales. Edie was formerly sales representative for Jessop in Cleveland, Ohio.

Alvin Zwerneman, vice president and sales manager of Axelson Manufacturing Co., announces the resignation of **J. L. Quisenberry** as advertising manager. Quisenberry has been associated with the Axelson organization for the past 10 years. **L. F. "Bill" Lutz,** who has also been a member of the Axelson organization for a number of years, will succeed Quisenberry.

Robert W. Duden has been elected president and **W. C. Berry** vice president of the newly organized Petroleum Equipment, Inc., of Tulsa, Okla. For the past 15 years Berry and Duden have been engaged in the handling of new and used oil-field and refinery equipment and immediately prior to their resignations served as officials of Refinery Equipment, Inc., Tulsa. The new corporation plans to operate under the policy of custom service to individual needs of producers and refiners throughout the United States, Canada, and Mexico, for complete refineries, pipe lines, storage units, or component parts thereof.

Election of **Leonard C. Peskin** as vice president—contracts of Kellett Aircraft Corp. is announced by **W. Wallace Kellett,** president.

J. L. Rodgers, president of Rodgers Hydraulic, Inc., Minneapolis, Minn., announces the appointment of **Hugh Krampe** as general sales manager.

New Deal Specialty Co., of Okmulgee, Okla., is making additions to its manufacturing facilities in order to increase output of their Butler spiders, elevators, and drilling clamps.

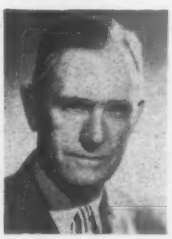
This carload contains 10 No. 96 Young Happy full-flow engine-jacket water coolers, complete with pumps, shutters, scale traps, V-belts, and B-15 Allis-Chalmers internal-combustion engines. It is consigned to destinations south of the border

M. L. VILLA

E. P. CANEPA

M. ARANGUREN

N. E. PALMER



J. D. ALLEN

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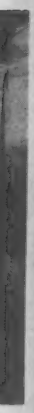

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